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PRODUCTION OF MONOSEX WHITE AMUR FOR AQUATIC PLANT CONTROL.(U)  
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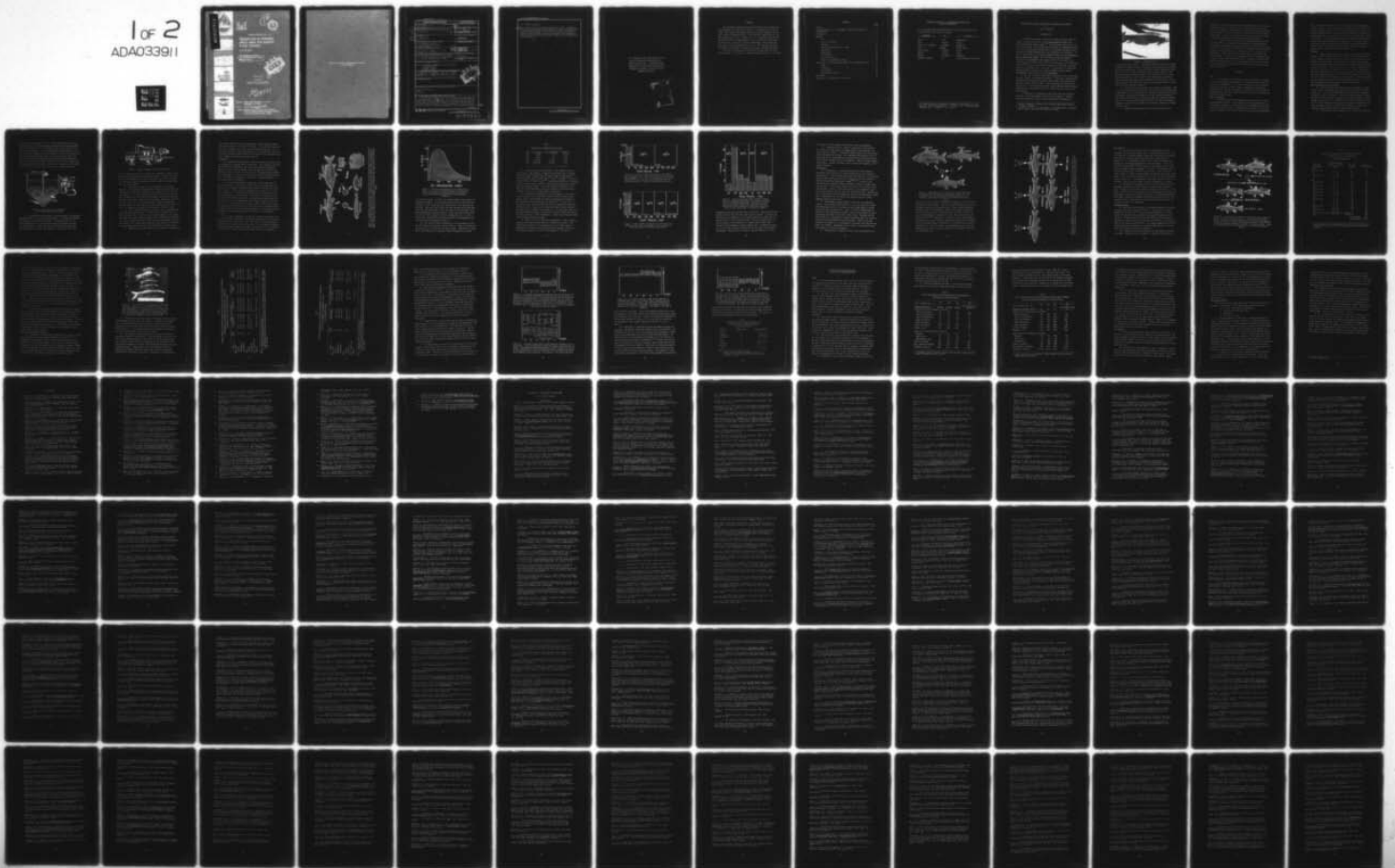
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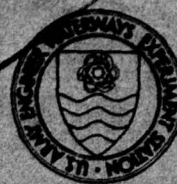


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PRODUCTION OF MONOSEX WHITE AMUR FOR AQUATIC PLANT CONTROL

OCT. 1976



CONTRACT REPORT A-76-1

## PRODUCTION OF MONOSEX WHITE AMUR FOR AQUATIC PLANT CONTROL

by Jon G. Stanley

U. S. Department of Interior  
Fish Farming Experimental Station  
Stuttgart, Arkansas



October 1976

Final Report

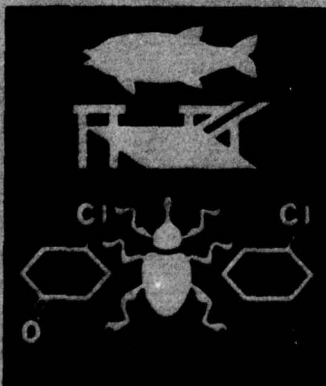
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20. ABSTRACT (Continued).

→ were studied as methods for making populations of one sex. Analysis of morphological and biochemical traits showed that monosex white amur could be produced and that these fish are identical to female fish produced by usual fertilization methods. A model for the costs of an operational hatchery facility and weed control program suggested that treatment cost with monosex amur would be \$150 per acre in 1975-77, but only about \$2 per acre after 1977. ↗

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## Preface

The information presented herein was performed in part under contract agreement No. APCP-3-73-1 with the U. S. Department of Interior (USDI), Fish Farming Experimental Station, Stuttgart, Arkansas, for the Office, Chief of Engineers (OCE). This study was conducted and the report prepared by Dr. Jon G. Stanley. Dr. E. O. Gangstad, OCE, was the Contracting Officer's representative for the contract; his assistance and constructive criticism is hereby acknowledged. The Mobility and Environmental Systems Laboratory of the U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi, monitored the report.

Director of WES during the preparation and publication of this report was COL J. L. Cannon, CE. Technical Director was Mr. F. R. Brown.

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Conversion Factors, U. S. Customary to Metric (SI)  
Units of Measurement

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
inches	2.54	centimetres
feet	0.3048	metres
miles (U. S. statute)	1.609344	kilometres
acres	4046.865	square metres
quarts liquid	0.94636	litres
gallons	3.78533	litres
pounds	0.45359237	kilograms
Fahrenheit degrees	5/9	Celsius degrees or Kelvins*

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\* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula:  $C = (5/9)(F - 32)$ . To obtain Kelvin readings, use:  $K = (5/9)(F - 32) + 273.15$ .

## PRODUCTION OF MONOSEX WHITE AMUR FOR AQUATIC PLANT CONTROL

by

Jon G. Stanley\*

### Introduction

1. Field and laboratory studies have shown that white amur fish (Figure 1), also called grass carp (Ctenopharyngodon idella), will effectively control aquatic weeds.<sup>1-8</sup> The white amur is an exotic fish imported from Asia. Its fusiform body is adapted for spawning migration up rivers. Specialized serrated teeth in the pharynx are used to shred vegetation, thereby allowing this fish to function as an herbivore. Amur are efficacious in controlling submersed plants such as Potamogeton, Egeria, Elodea, and Najas. This fish shows particular promise in eradication of Myriophyllum and Hydrilla, which are not easily controlled by other methods. They also feed on some species of filamentous algae,<sup>2,3,9,10</sup> thus preventing the development of obnoxious scums that occur after vegetation dies. White amur is ineffective in controlling emergent aquatic plants such as cattails (Typha),<sup>4</sup> water hyacinth (Eichhornia),<sup>5</sup> and alligator weed (Alternanthera).<sup>5</sup>

2. The cost of aquatic weed control using white amur is less than that with chemical or mechanical treatment.<sup>4</sup> Generally a stocking level of 20-50 fish per acre\*\* is required, and currently these fish can be produced for less than \$1.00 each. One stocking may be effective for about 6 years.<sup>4</sup> Thus vegetation control can be achieved with an initial investment of less than \$50 per acre, or \$8 per acre for each year of effectiveness.

3. Objections to releasing the white amur have been raised by officials in State and Federal natural resource agencies. Several states have proposed or enacted regulations against introducing or

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\*\* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 4.

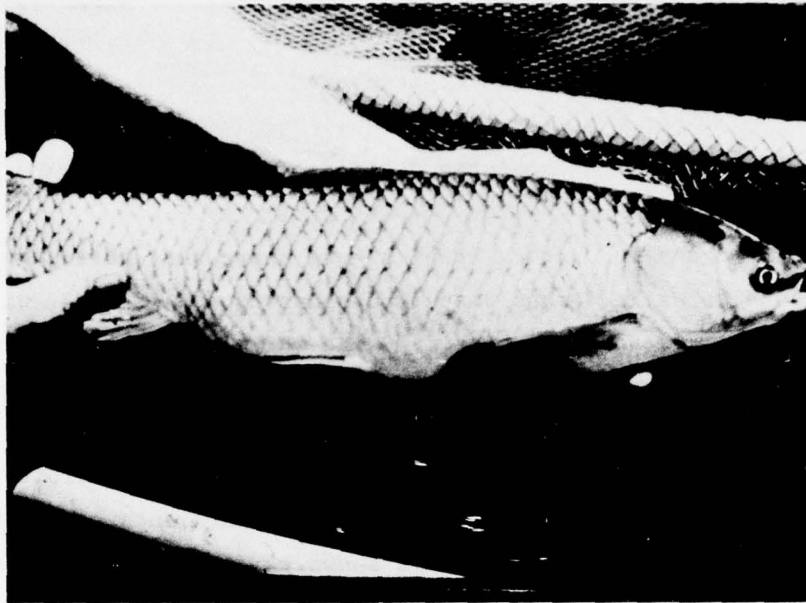


Figure 1. The white amur

stocking this exotic species. Proposed Environmental Protection Agency regulations<sup>11</sup> require a permit for holding and culturing exotic species, including the white amur. Fish and Wildlife Service regulations under the Lacey Act<sup>12</sup> prohibit importation and interstate commerce of the white amur unless a permit is obtained from the Director of the Fish and Wildlife Service. The threat of court injunctions initiated by private conservation groups further inhibits use of this fish. These legal and policy restraints are based on the potential menace this fish poses to native fish and wildlife.<sup>13</sup>

4. The white amur could become a pest in the United States. Some of the same characteristics which make it effective in controlling undesirable weeds in some areas might be a liability should this fish escape to important waterfowl, marsh habitat, or other natural ecosystems.<sup>14</sup> Observations on the effects of white amur have been limited, partially due to the reluctance of waterfowl biologists and other environmental managers to test the fish in habitats vulnerable to disruption through vegetation loss.

5. Competition between native fish and young white amur is



probable. The young of almost all fish, including white amur, feed on zooplankton and insect larvae; adults of many fish species also eat these food organisms. The capacity of white amur for food competition has been shown,<sup>15-17</sup> but not with species of native fish most likely to be affected. Effects of competition could be reduced if larger individuals were stocked and if reproduction could be prevented.

6. Several methods are known for obtaining nonreproducing fish populations.<sup>18</sup> The limitations and potentials of each method were considered, and gynogenesis and sex reversal were selected as the most feasible for application to white amur. Gynogenesis is the development of an egg after penetration by a sperm that does not contribute to inheritance. Since there is no male inheritance, the offspring are totally female. In sex reversal, immature fish are fed androgen (male hormone) to cause male sex differentiation. However, often treatment does not reverse the sex of all fish and thus some females can remain in the population. Sex reversal has been successful in several other species of fish.<sup>19-21</sup>

## Research

### Aim

7. The objective of this research was to determine the feasibility of producing nonreproducing white amur fish that could be used in aquatic weed management. Use of monosex fish would have an advantage over use of both sexes of amur because environmental risk would be minimized with no decrease in benefits. Monosex amur were achieved by fertilizing amur eggs with irradiated sperm from carp. The methods are described in detail below.

### Care of broodfish

8. White amur used as the female parents were at least 3 years old and weighed 12-30 lb. It was possible to obtain eggs from fish in poor physical condition, but fertile eggs were obtained only from fish in good physiological state. To maintain the good health of the fish, they were stocked at less than 20 fish per acre and given supplementary

feed. Broodfish were handled once each year at the time of spawning. Seining was always conducted early in the morning or on cloudy days to prevent temperature shock. The fish were transported to the laboratory in well oxygenated water to which was added an anesthetic--quinaldine (2-methylquinoline). They were held at 73-77°F in 150-gal tanks covered with netting. They were handled only to give injections and take eggs and then only under anesthesia with quinaldine. Carp used to supply sperm were stocked at the rate of 160 fish per acre and fed commercial catfish pellets. Each male carp was used several times during one season, with a 2-week recovery period between uses.

#### Spawning

9. Eggs and sperm flow from white amur and carp were induced by hormones. Males of both species were injected intraperitoneally 12 hr prior to sperm need with 0.8 mg/lb of acetone-dried carp pituitary suspended in distilled water. One part sperm was mixed with four parts cold Hanks' balanced salt solution without bicarbonate and then refrigerated until needed. Female carp received one 5-mg/lb intraperitoneal injection of pituitary to induce ovulation 12 hr later. Female white amur were administered three injections consisting of 200 IU/lb human chorionic gonadotropin (HCG) on the first day, 800 IU/lb on the second day, and 5 mg/lb of carp pituitary on the third day. Ovulation in both species occurred about 12 hr after the pituitary injection. Fish were anesthetized with 50 ppm quinaldine prior to spawn taking.

#### Egg incubation and care of young

10. In nature, white amur spawn in the open channels of large rivers. Their semibuoyant eggs float in the river current until the larvae hatch. In artificial reproduction, the process of suspending the eggs in water is simulated. Semibuoyant eggs are generally incubated in 5-qt McDonald jars, cylinders with a hemispherical or conical bottoms, in which water is introduced at the bottom and flows out the top.<sup>22</sup> These incubators were tested but were found unsatisfactory for white amur eggs because of the frequent adjustments of water flow needed to achieve proper rolling of eggs without overflow.

11. In the Soviet Union, incubators up to 50 gal in volume are

used for white amur eggs.<sup>23</sup> The U. S. Fish and Wildlife Service conducted tests in a 55-gal fiberglass container (Fiber Tech Engineering, Santee, CA), which is 30 in. in diameter, 30 in. deep, and has a 45° conical bottom (Figure 2). About 300,000 eggs were incubated in each pot. Water was introduced near the bottom at the rate of 1 gal per min and then discharged through a pipe on the side near the top of the vessel. Water flow was adjusted frequently as the eggs swelled and became more buoyant. Hatching time was 25-30 hr at 75°F. Larvae swam up and out the overflow and were collected in a basket (5.5 in. long by 9 in. wide by 5 in. deep) made of 50 mesh per in. Saran screening.

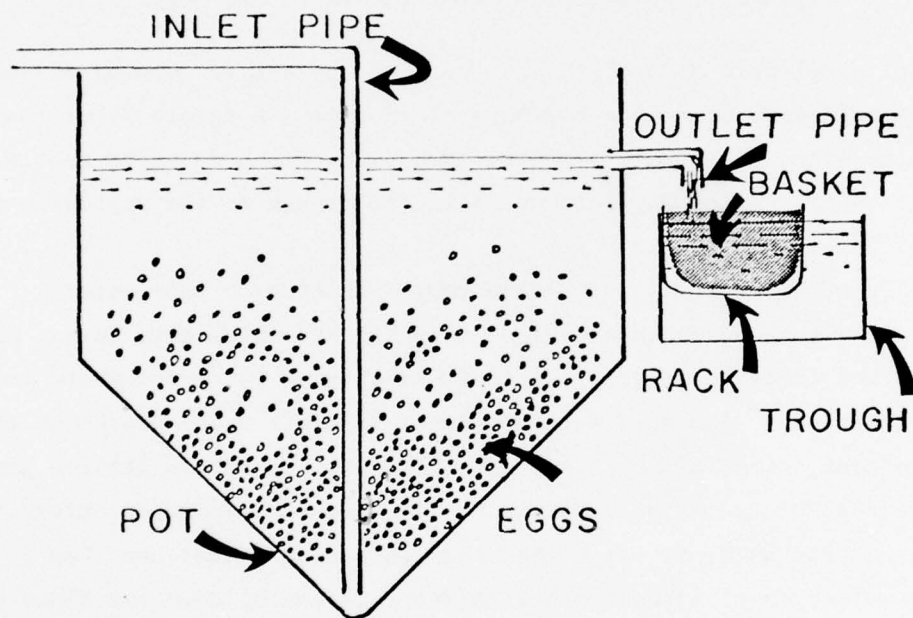


Figure 2. Hatching pot for incubation of semibuoyant eggs of white amur

12. A capability for incubation of separate groups of gynogenetic eggs was needed to test production procedures. A catfish-type hatchery was modified to achieve this objective. This hatchery was a 2- by 12-ft trough with 12 in. of water with Saran-screen baskets to hold the eggs (Figure 3). About 2500 eggs were incubated per basket and each trough held 20 baskets. The baskets (5 in. long by 8 in. wide



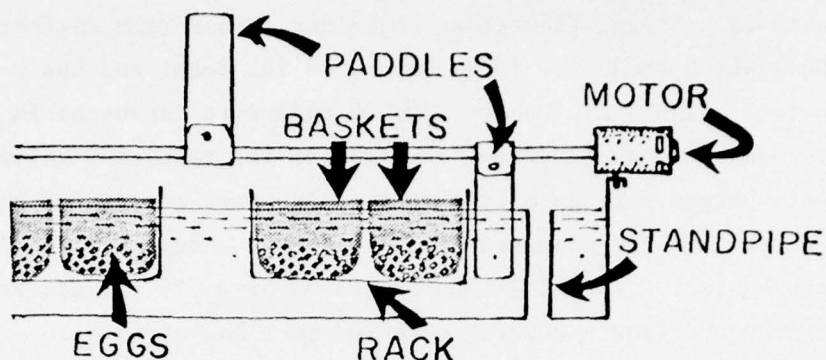


Figure 3. Basket incubator for white amur eggs

by 4 in. deep) were made of 50 mesh per in. screening. Groups of four baskets were supported by a hardware cloth rack. A paddle 9 in. long and 3 in. wide rotated at 15 rpm on each side of the racks to gently stir the eggs. Water was introduced in the trough at the approximate rate of 1 gal per min.

13. Fish eggs and larvae are very sensitive to poor water quality. A copepod which attacked newly hatched white amur larvae and fluctuation in temperature prohibited use of pond water for white amur egg incubation. Also well water to be used in the tests was known to have concentrations of ferrous iron, nitrogen, and carbon dioxide gas that were suspected of being toxic to fish eggs. Therefore, before the well water was used, it was passed through a sand filter and then through a series of three tanks with water cascading down the sides of each. In addition, two agitators were placed in the first tank.

14. Newly hatched larvae were counted by using a glass-bottomed pan illuminated from the rear. A black surface was placed 0.25 in. below the pan bottom. The 6- by 15-in. pan was marked in 1-in. grids. The larvae were removed from the baskets with a finger bowl and placed in 0.5 in. of water in the pan. After they ceased swimming, the fish were counted. The larvae were removed and then placed in a trough with Saran screening (50 mesh per in.) over the drain to prevent escape.

15. Beginning 2 days after hatching, the young were fed egg yolk.

The yolk was removed from a hard-boiled egg, frozen, and then rubbed under water between the thumb and forefinger. The resulting yolk particles were of adequate size to be eaten by the white amur fry. At 4-6 days after hatching, brine shrimp nauplii were substituted for egg yolk. Fry were stocked into newly filled 0.1-acre ponds on the seventh day and fed a complete ration of meal 5 times per week.

#### Gynogenesis

16. Gynogenesis was achieved in eggs "fertilized" with sperm that was irradiated to denature DNA in chromosomes. Thus, paternal influence was excluded from inheritance and progeny had exclusively maternal genetic material. Monosex broods consisting entirely of females were produced. These fish were typical white amur and should be as effective as a combination of both sexes for biological control of aquatic vegetation. By using only females the possibility of naturalization in receiving waters was minimized.

17. To produce gynogenesis, sperm from a heterologous species was used (Figure 4). Sperm from a different species assured that mistakes due to inadequate irradiation would result in hybrids that would die. In 1972, goldfish sperm was irradiated with X-rays for 50 min at 75 kiloroentgens. In 1973 and 1974 (the Israeli mirror variety) carp sperm was irradiated with UV light. A 1-mm layer of sperm solution in a 4-in.-diam Petri dish was placed on a smaller Petri dish filled with crushed ice. The milt solution was then irradiated with 6.5 milliwatt per sq in. of UV (60 min in 1973, 15 min in 1974). The shorter irradiation time was chosen after tests in 1974 showed that sperm effectiveness decreased after 60 min of UV irradiation (Figure 5). The sperm solution was mechanically agitated during UV irradiation at 50 oscillations per min.

18. In 1972, gynogenetic progeny were produced in one white amur. Of the 40,000 eggs in the spawn, 34 fish that appeared to be normal were obtained and 6 are surviving to date (June 1975). In 1973, gynogenesis again occurred in eggs from one white amur. Of 75,000 eggs 133 diploids (fish that appeared normal) were found. Resulting fry were fed hormones in an attempt to reverse the sex (see below), and 42 were stocked in

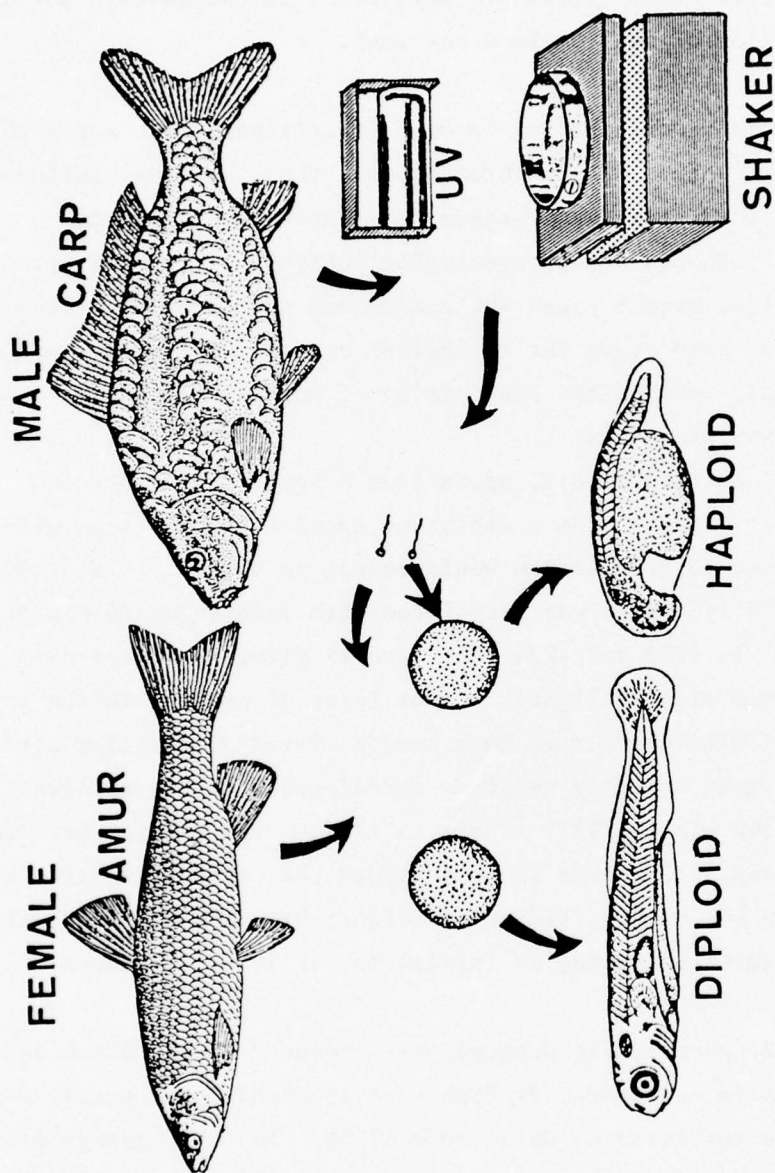


Figure 4. Gynogenesis in white amur was achieved by fertilizing amur eggs with UV-irradiated milt. Two kinds of progeny resulted: diploids that had two complete sets of chromosomes, and haploids that had one set of chromosomes. Diploids grew into typical amur and haploids died. Because male inheritance was eliminated by irradiation the offspring were exclusively female



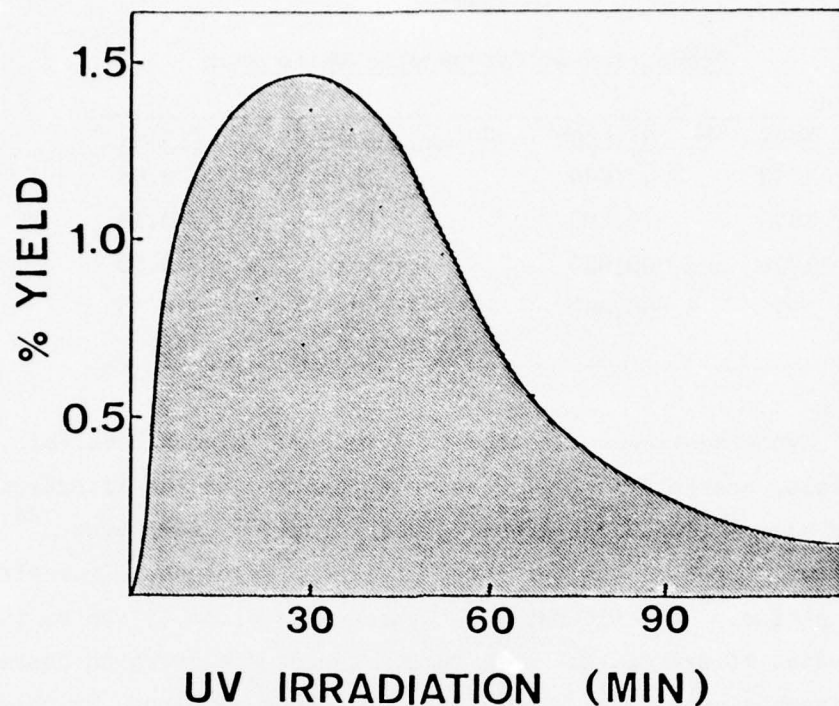


Figure 5. Effect of the duration of UV irradiation of sperm on the yield of diploid gynogenetic white amur. These data suggest that maximum yield is obtained at a UV dose which denatures DNA without altering sperm viability

five 0.25-acre ponds. In 1974, two females produced large numbers of gynogenetic progeny. Of 115,000 eggs from one fish, 4,230 amur were obtained, and of 143,000 eggs from another fish, 3,632 diploid fish resulted. Fish with lesser yields gave 805 diploids from 82,000 eggs and 1,334 from 92,000 eggs. Thus, of nearly 0.5 million eggs, 9,971 diploid gynogenetic progeny resulted. Eight other females delivered 1.4 million fertile eggs, but with no gynogenetic fish. In 1975, 5 million eggs obtained from 25 females yielded 21,100 gynogenetic fry. The production is summarized in Table 1.

19. The yield of diploid gynogenetic fish was greater in 1974 and 1975 than in the previous 2 years (Table 1). About 0.5 percent of the eggs of four fish with fertile eggs hatched. Expressed as a probability, the chances of an egg being diploid gynogenetic was 0.005.

Table 1  
Production of Gynogenetic White Amur

<u>Year</u>	<u>No. of Eggs</u>	<u>No. of Diploids</u>	<u>Yield, %</u>
1972	40,000	34	0.08
1973	75,000	133	0.18
1974	2,000,000	9,971	0.50
1975	5,000,000	21,126	0.55

20. Gynogenesis was also observed in carp, bigmouth buffalo, black buffalo, and goldfish. It has been reported in the literature in striped bass,<sup>24</sup> loach,<sup>25</sup> perch,<sup>26</sup> brook trout,<sup>27</sup> brown trout,<sup>28</sup> rainbow trout,<sup>29</sup> rudd,<sup>30</sup> silver carp,<sup>31</sup> cisco,<sup>29</sup> sturgeon,<sup>32</sup> sterlet,<sup>32</sup> beluga,<sup>32</sup> plaice,<sup>29</sup> and flounder.<sup>29</sup> Gynogenesis probably can be induced in any species if care is taken to remove the dead eggs which contaminate the incubation medium. Thus, the techniques developed by this study have wide application in genetics research and selective fish breeding as well as in creating monosex populations.

21. Spontaneous gynogenesis occurs infrequently in all species. In some species cold or heat shocks increase yield of diploid gynogenetic fish. Cold temperature extremes interfere with expulsion of the second polar body needed here for diploid.<sup>25,28</sup> In all tests except one, cold shocks decreased the yield of gynogenetic white amur (Figures 6 and 7). Eggs from one female responded to both cold and warm shocks with increased yield (Figure 8). In loach, the response of eggs from different females to temperature varied,<sup>25</sup> which may explain the varied results in these experiments. Pressure and colchicine tests caused complete mortality to eggs.

22. Monosex fish were expected in gynogenesis. This is because paternal inheritance was eliminated by irradiation of sperm. This expectation was based on the assumption that sex of white amur is determined by inheritance (two X chromosomes for female; and X and Y chromosomes for male) as in carp<sup>33</sup> and goldfish.<sup>20</sup> The sex of

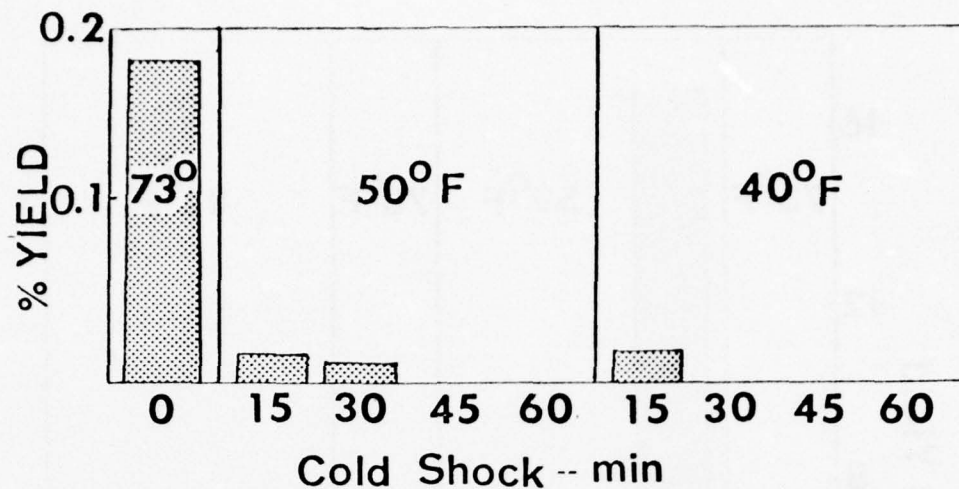


Figure 6. Exposure of white amur eggs to cold temperature beginning 1 min after fertilization did not increase the gynogenetic yield. This was contrary to expectations because other fish respond to such treatment with increased percentage of eggs that develop gynogenetically

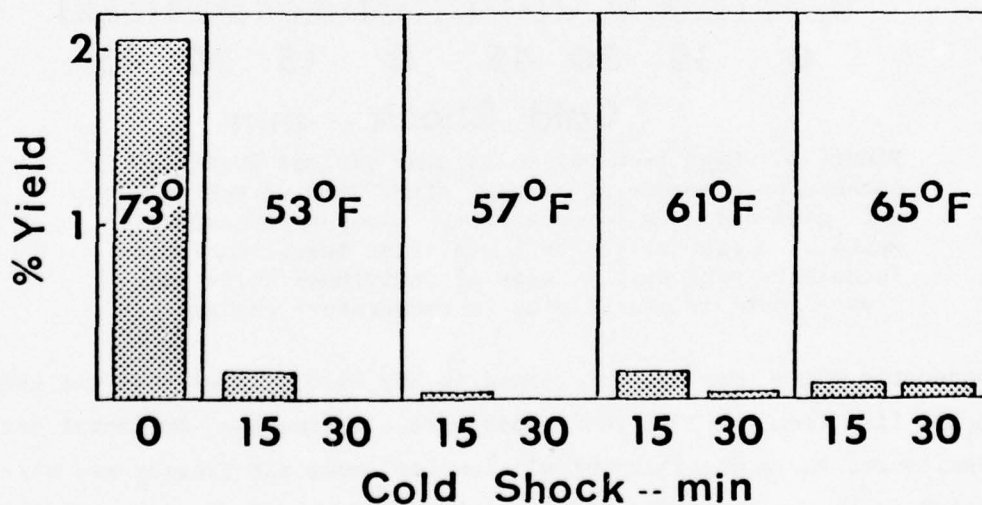


Figure 7. Mild temperature shocks were ineffective in increasing the yield of gynogenetic fish. Exposure to cool water began 1 min after fertilization



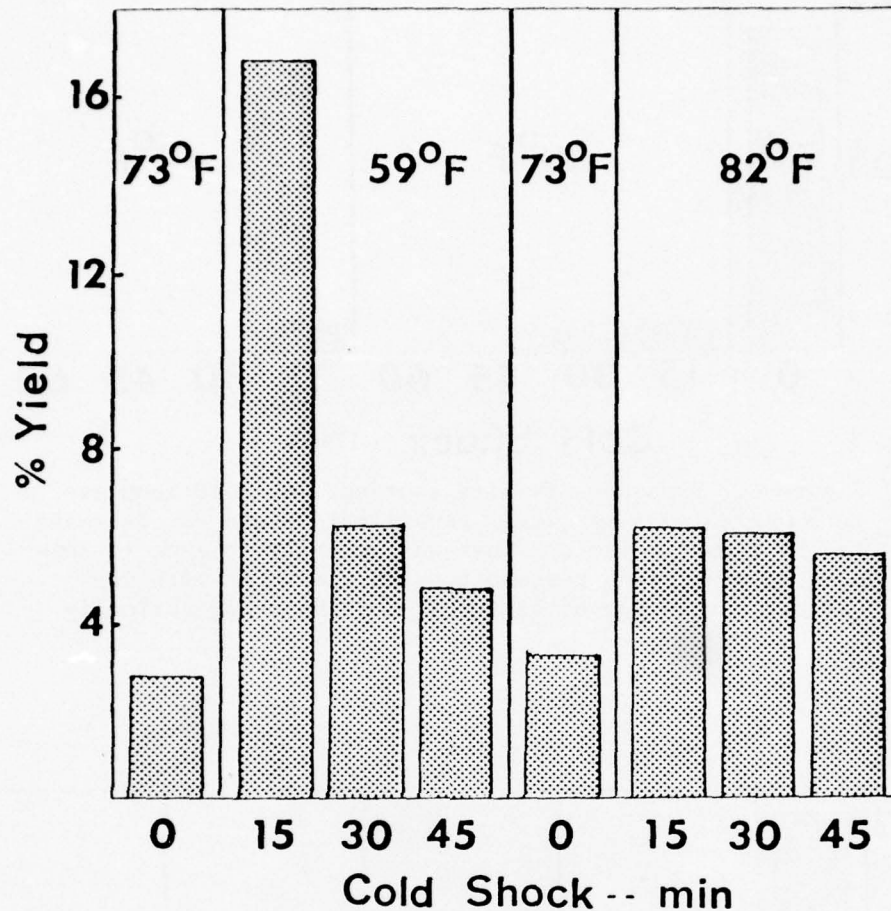


Figure 8. Eggs from one white amur yielded increased numbers of gynogenetic progeny after eggs were treated with cool and warm temperatures. Exposure to experimental temperatures began 1 min after fertilization. These data suggest that eggs of individual white amur vary in their sensitivity to temperature changes

gynogenetic white amur was determined in May 1975. Three-year-old gynogenetic fish from the 1972 year class were all females. In normal sex inheritance, the probability of all females among six progeny was calculated to be  $p = 0.015$  (binomial test). Thus the observed sex ratio was not likely to be accounted for by random chance alone, which indicates that gynogenesis produces monosex fish. Gynogenetic progeny of the 1973 year class were examined and no males were found among the individuals. Males mature at 2 years of age and females at 3 years.

The absence of males suggests monosex white amur in gynogenesis.

23. Gynogenesis may not result in monosexes in every species. For example, sex inheritance in Tilapia aurea is WY chromosomes for female and YY for male.<sup>34</sup> Gynogenetic progeny would be of two possible types--WW females or YY males. The combination WY would not occur if the second set of chromosomes were derived from the second polar body since sister chromosomes would be recombined. The WW fish have special significance. Mating a WW female with a YY male would produce all WY female offspring.

#### Androgenesis

24. Androgenesis is another deviation from normal embryonic development with potential for monosex production of fish (Figure 9). Androgenesis is a rare phenomenon in which fertilization is by two sperm and the female chromosomes are lost. Reports in fish are limited to haploids produced by irradiation of eggs.<sup>28,35,36</sup> In these tests androgenesis was observed on three occasions in hybrid of female carp and male amur. Only six were found in the first two occasions from an unknown number of eggs. On the third occasion, 43 androgenetic amur were recovered from 2,500 fry that came from 110,000 eggs. Another pond stocked with 1,800 fry from 50,000 eggs did not yield androgenetic white amur. Androgenesis was not observed in numerous crosses of wild Cyprinus carpio and white amur.

25. Androgenetic progeny probably came from a few individual females. This probability was about 0.7, i.e., the fraction of ponds with androgenetic fish (0.5) divided by the average number of female parents involved per pond (7.5). Thus, 1 out of 14 females might be expected to give androgenetic progeny. Even in those females in which androgenesis occurred, it was not a likely event. Assuming that one female gave all 43 androgenetic progeny from 18,000 eggs, the chance of one egg developing androgenetically was 0.0002. Based on all eggs examined, the probability of androgenesis occurring in any egg from any female was 0.00003. Androgenesis is not likely to be detected unless large numbers of hybrids are examined.

26. Androgenesis is thought to result from fertilization of an

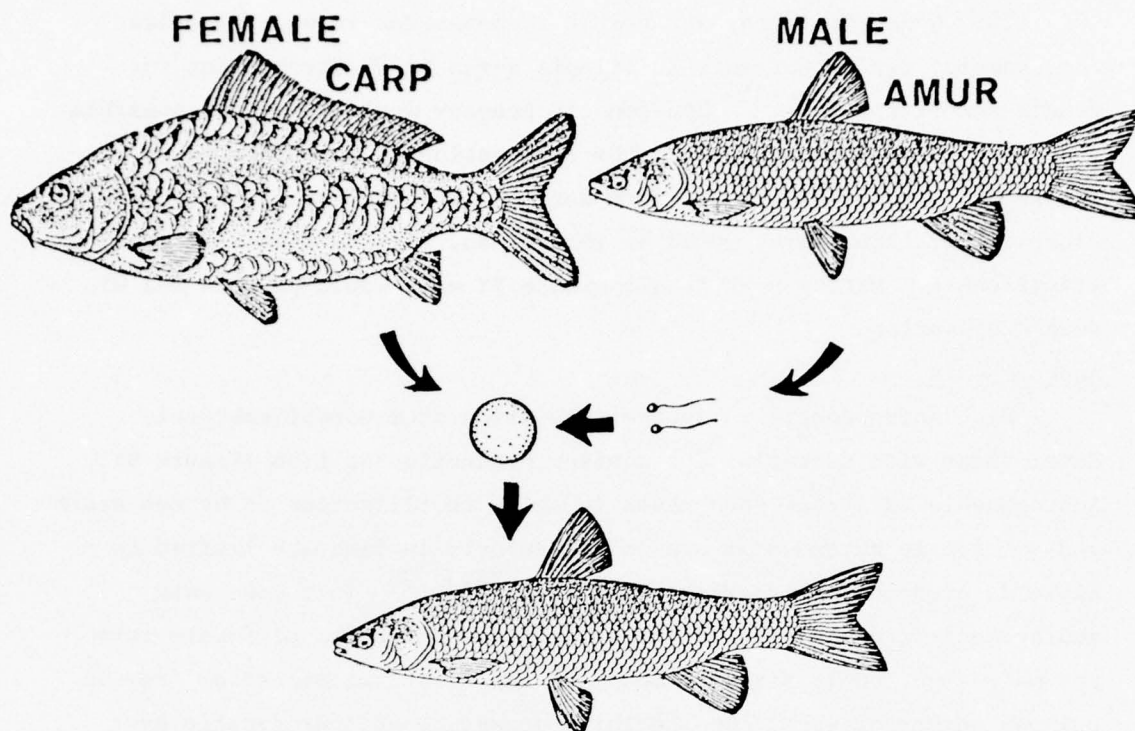


Figure 9. Androgenesis is a variation from normal embryonic development that has potential for monosex production. Fertilization is by two sperm and the female genome is lost. Offspring inherit only paternal traits from the white amur parent

egg with two sperm (Figure 9) followed by elimination of the odd set of chromosomes from the mother. Thus, the offspring contains two sets of chromosomes derived from separate sperm. There are three genotypes dependent on the sex chromosomes carried by each sperm (Figure 10). With two X-bearing sperm, a female results, an X and a Y result in a male, and YY produces an unusual male type. The YY genotype is not lethal in fish.<sup>37,38</sup> When bred to a normal XX female, this unusual male produces all male offspring. Thus, monosex males can be produced in the second generation. The problem is in identifying the unusual combination YY. Only one third of the androgenetic males carry this combination, and test crossing is necessary to distinguish them from the normal male type.



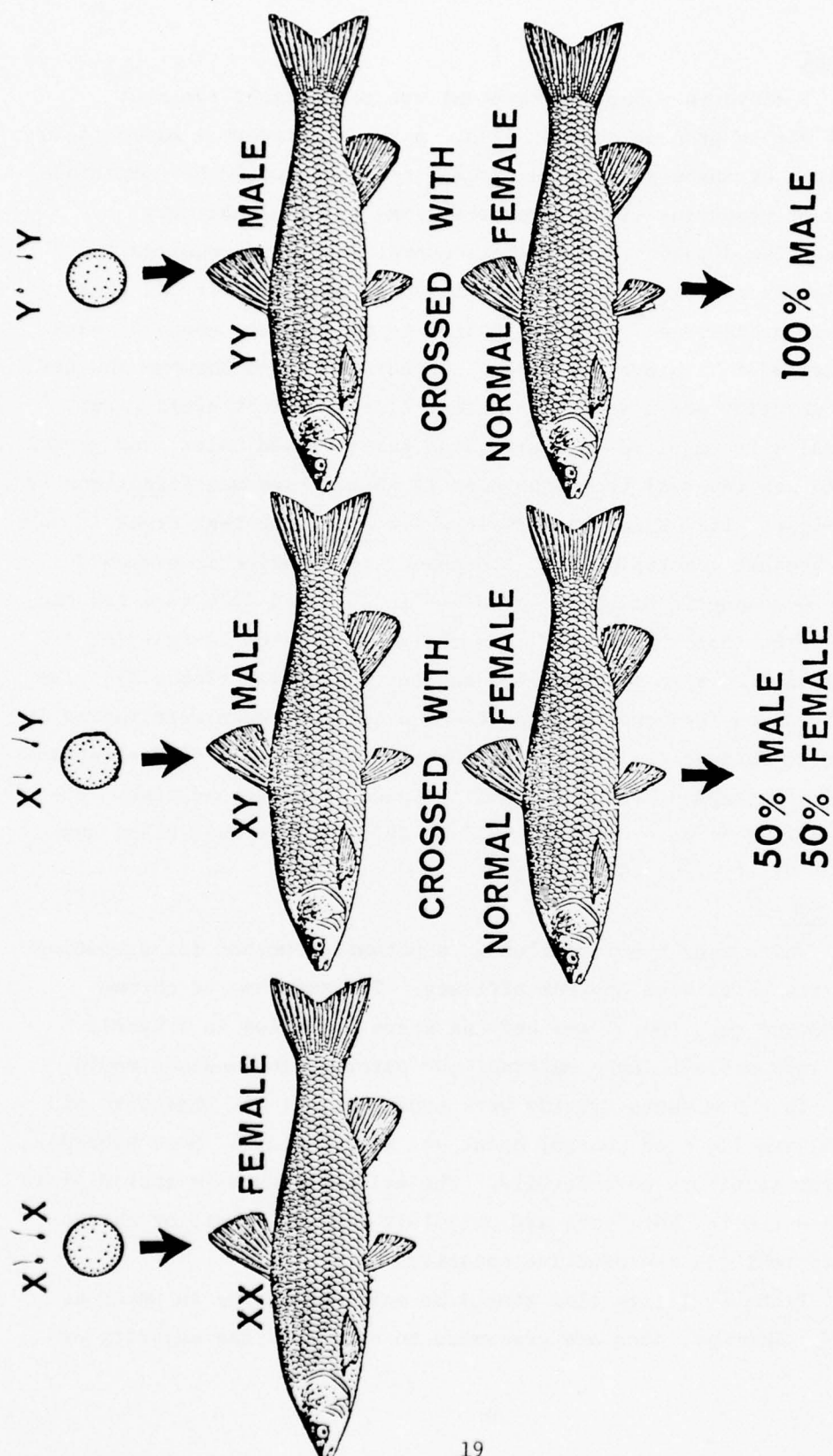


Figure 10. Androgenetic white amur have potential for production of all-male populations. Although androgenetic progeny are not monosexes, about 25 percent have an unusual combination (YY) of sex chromosomes. These YY males mated to ordinary XX females produce 100 percent male progeny

### Sex reversal

27. Techniques using sex reversal are potentially the most economical way to produce monosex fish. A few sex-reversal males could sire millions of monosexed female progeny and costs would be comparable with those of producing mixed-sexes offspring by usual hatchery techniques. The disadvantage is that several years are required for rearing the sex-reversed broodfish to serve as parents. If the usual sex reversal procedures<sup>19,20</sup> were applied to white amur, about 5 years would be needed to achieve monosexes: 3 years to raise hormone-fed fry to sexual maturity and 2 years for a test cross. A test cross with normal females is required to distinguish sex-reversed males from normal males. The sex reversal technique used in these tests was significantly shorter (Figure 11). With gynogenetic white amur, the test cross is unnecessary because genotypic males are absent in gynogenetic progeny.

28. Gynogenetic offspring produced in 1973 and 1974 were fed the androgen, methyltestosterone [17( $\alpha$ )-methyl-A<sup>4</sup>-androsten-17-( $\beta$ )-01-3-one]. Hormone-fed fish totaled 1085 and controls, 1147 (Table 2). The length of time on feed and the age at which feeding began were varied in an attempt to deliver the hormone at the time of sexual differentiation. This range of treatment assuredly will produce sex-reversed fish. Effectiveness will be determined in 1975 or 1976 for the 1973 class and in 1976 or 1977 for the 1974 class.

### Carp-amur hybrids

29. White amur hybridization is a potential method for producing a sterile fish with weed control efficacy. The amur has 48 chromosomes<sup>39</sup> and the carp 100,<sup>40</sup> and egg and sperm formation in a hybrid should be impossible because maternal and paternal chromosomes would not pair. In these tests hybrids were produced, but the objective of a practical sterile weed control agent was not obtained. Most hybrids died and the survivors were fertile. The evidence suggests that diploid fish die and the few survivors are polyploid (multiple sets of chromosomes) with restored reproductive capacity.

30. Probably little else should be said concerning an unsuccessful method. However, data are presented to show that the majority of

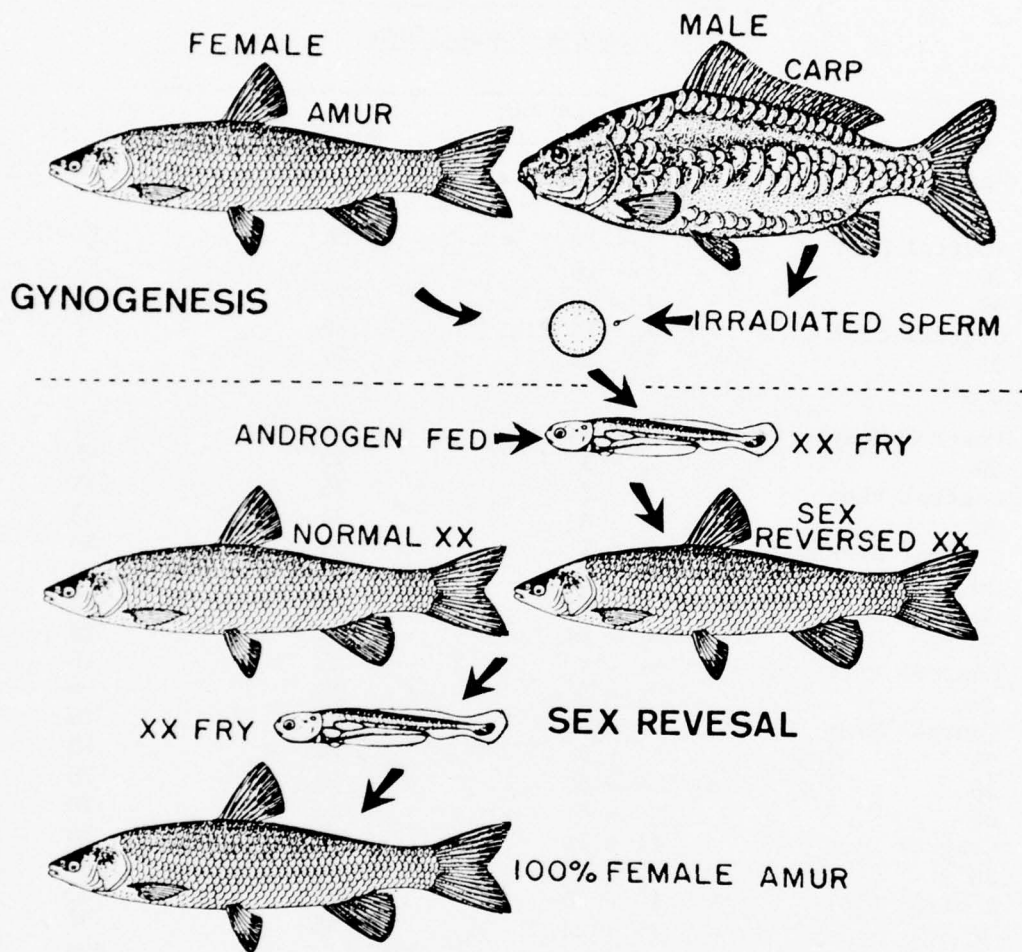


Figure 11. Sex reversal technique is the most practical method for monosex production of white amur fish. Male fish having female genotype are made by feeding androgen (male hormone) to gynogenetic young. Mating sex-reversed males (female type) with normal females in ordinary hatchery operations results in all-female broods. Costs are comparable with usual hatchery costs for producing mixed-sex broods



Table 2

White Amur (Gynogenetic) Fed Methyltestosterone\*  
to Reverse the Sexes for Production  
of Monosex Populations

<u>Treatment</u> <u>mg/kg Feed</u>	<u>Age at Beginning</u> <u>and End of Feeding</u> <u>weeks</u>	<u>No. of</u> <u>Fish Fed</u>	<u>No. of</u> <u>Fish Stocked</u>
1973			
Control Diet	1 - 10	26	12
30	1 - 10	27	10
60	1 - 10	27	8
Control Diet	4 - 14	26	7
30	4 - 14	27	5
1974			
Control Diet	1 - 3	50	50
30	1 - 3	50	50
Control Diet	6 - 8	35	35
30	6 - 8	35	33
Control Diet	1 - 5	50	50
30	1 - 5	50	50
Control Diet	6 - 10	35	35
30	6 - 10	35	29
Control Diet	1 - 7	25	18
30	1 - 7	25	4
Control Diet	4 - 8	70	70
30	4 - 8	70	70
30	4 - 8	70	70
60	4 - 8	70	70
Control Diet	11 - 15	35	35
30	11 - 15	35	26
Control Diet	16 - 20	35	35
30	16 - 20	35	34
Control (no feed, stocked directly in ponds)			800
30	4 - 8	about 650	626
Total Control			1147
Total Androgen			1085

\* Methyltestosterone was incorporated into the diet at either 30 or 60 mg/kg of feed. No other feed was presented during the feeding interval.

hybrids are inviable and the few survivors are capable of reproduction. The time of hybrid mortality depended on whether the carp or white amur served as the maternal parent. Hybrids of amur female X carp male invariably died during embryonic development. A few abnormal larvae hatched but never reached the active feeding stage. Makeeva and her coworkers in the Soviet Union<sup>41,42</sup> report similar findings; of 500,000 eggs no hybrids were produced. The reciprocal cross between carp female and amur male developed normally, although mortality was high. Of 110,000 eggs, 2,500 hatched, were fed, and stocked into a pond. Only 5 survived to 3 mo of age. In a second lot of 50,000 eggs, 1,800 were stocked but only 11 were present when the pond was drained 3 months later. Similar ratios were found when the wild carp was used as the mother. About 500 hybrid fish were produced during 3 years. These were of value because they could be used for comparison with gynogenetic and androgenetic amur (Figure 11). Carp-amur hybrids are described in References 41 and 43-45.

31. In a study of reproductive capability conducted in cooperation with Janice Hughes and Louis Richardson of the Louisiana Conservation Department, it was found that hybrids were capable of forming fertile reproductive products. Backcrosses with the carp were more successful than second generation ( $F_2$ ) matings with siblings. Of 15,000 hybrid eggs backcrossed by fertilizing with carp sperm, 4,910 larvae hatched and 61 percent were abnormal. Of 1,837 larvae, 40 percent were abnormal from 17,000  $F_2$  eggs. Therefore, it is recommended that no further work be done on hybrids.

#### Purity of experimental progeny

32. Gynogenetic or androgenetic progeny may not be pure. Paternal inheritance occurs in presumed gynogenetic silver carp.<sup>31</sup> If gynogenetic or androgenetic amur are not pure, they might perform differently than do normal progeny. These fish look like white amur (Figure 12), but carp inheritance must be completely excluded. Morphological and biochemical evidence shows experimental progeny to be identical to normal white amur. If inheritance included carp genes, some traits would be intermediate between the two parental species.

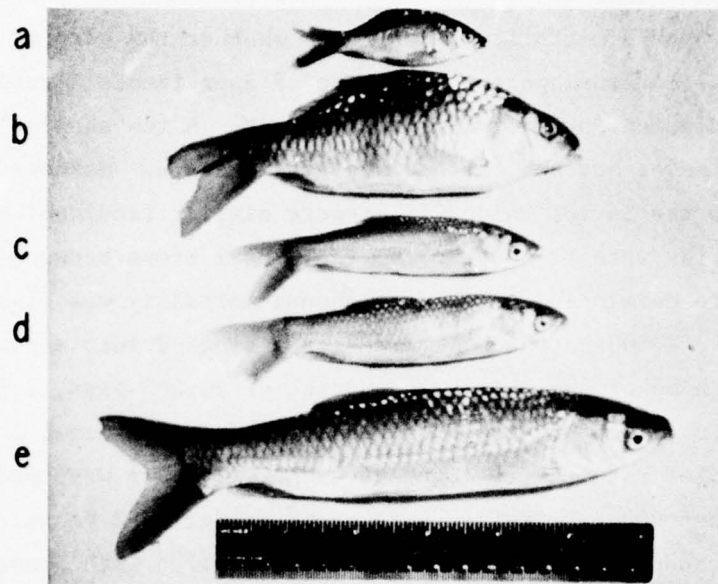


Figure 12. The white amur is morphologically distinct from carp. The carp (a) is partially scaleless. The carp-amur hybrid (b) is intermediate between carp and amur in appearance. Gynogenetic amur (c), normal amur (d), and androgenetic amur (e) are indistinguishable. This shows that gynogenetic and androgenetic amur are pure with no inheritance from the carp father

33. The number of fin rays, lateral line scales, and gill rakers distinguished white amur from carp (Table 3). Hybrids were intermediate. The dorsal and anal fins of all three forms had three (III) spinous rays, but only the carp and the hybrid had a strongly serrated third spinous ray. These characteristics in gynogenetic and androgenetic amur were similar to those of normal amur.

34. The different body dimensions were less useful in distinguishing the kinds of fish (Table 4). Only the length of the dorsal fin base clearly separated hybrids, carp, and amur; it was longest in the carp, shortest in the amur, and intermediate in the carp-amur hybrid, reflecting the number of fin rays. Head length and body depth were poor diagnostic traits. Although amur, carp, and carp-amur hybrids all significantly differed from each other, there were also significant differences in head length among normal, androgenetic, and gynogenetic

Table 3

Average Number of Fin Rays, Lateral Line Scales, and Gill Rakers in Normal, Androgenetic, and Gynogenetic White Amur, Normal and Gynogenetic Carp, and Carp-Amur Hybrids

Form	No. of Fish	Number of Fin Rays*		Lateral Line Scales*	Gill Rakers*
		Dorsal Fin	Anal Fin		
White Amur					
Normal	10	[ III 7.1 (0.10)	[ III 8.1 (0.10)	[ 40.5 (0.53)	[ 15.0 (0.36)
Androgenetic	10	III 7.0 (0.00)	III 8.0 (0.00)	40.6 (0.30)	14.3 (0.49)
Gynogenetic	10	III 7.0 (0.00)	III 8.0 (0.00)	40.0 (0.42)	14.7 (0.21)
Carp					
Normal	10	[ III 19.9 (0.31)	[ III 6.0 (0.00)	[ 11.4 (1.62)	[ 26.6 (0.29)
Gynogenetic	1	III 21.0 ----	III 6.0 ----	7.0 ----	26.0 ----
Carp X grass carp					
Hybrid	7	III 16.0 (0.62)	III 6.0 (0.00)	33.8 (1.14)	16.4 (0.20)

Note: Standard errors are in parentheses.

\* A mean value enclosed by a bracket does not differ significantly from other values within that same bracket but differs significantly at the 95 percent level from all values outside that bracket.



Table 4

## Average Body Dimensions of Normal, Androgenetic, and Gynogenetic

## White Amur, Normal and Gynogenetic Carp,

## and Carp-Amur Hybrids

Form	No. of Fish	Percent of Total Length*		
		Head Length	Body Depth	Base of Dorsal
White Amur				
Normal	10	21.9 (0.44)	[ 17.7 (0.26)	[ 8.1 (0.14)
Androgenetic	10	18.8 (0.30)	18.4 (0.27)	8.3 (0.14)
Gynogenetic	10	19.2 (0.35)	19.2 (0.21)	[ 8.2 (0.12)
Carp				
Normal	10	[ 23.4 (0.45)	29.4 (0.21)	[ 32.4 (0.66)
Gynogenetic	1	[ 24.2 -----	38.0 -----	[ 34.9 -----
Carp X grass carp				
Hybrid	7	20.9 (0.74)	31.9 (0.29)	27.8 (0.81)

Note: Standard errors are in parentheses.

\* A mean value enclosed by a bracket does not differ significantly from other values within that same bracket but differs significantly at the 95 percent level from all values outside that bracket.

amur. These differences did not follow a pattern of intermediacy between species and are thought to be environmentally induced.

35. The pharyngeal teeth formula varied greatly within normal carp, making count comparisons meaningless. The carp had molar-type teeth distinctly different from the serrated, rasping teeth of the amur, and the hybrid had teeth much like the carp. Gynogenetic and androgenetic white amur were similar to normal amur.

36. Electrophoretic analysis of plasma and other body fluids is a method of detecting hybrids.<sup>46,47</sup> Here, the objective was to demonstrate that the gynogenetic and androgenetic white amur were not hybrids but pure white amur. Electrophoresis of hemoglobin, blood plasma proteins, esterases, and lactate dehydrogenase was done on an EC 470 and EC 490 apparatus (EC Apparatus Corp) using polyacrylamide block gel and Peacock buffer at pH 8.4. In all, 29 samples from normal white amur, 17 from normal carp, 213 from gynogenetic white amur, 17 from androgenetic white amur, 1 from gynogenetic carp, and 5 from hybrids were analyzed. The work was done by Charles J. Biggers and Don E. Schultz of Memphis State University. They found that gynogenetic fish had no paternal inheritance and that androgenetic fish had no maternal inheritance.

37. Hemoglobin from carp and white amur had three electrophoretic bands (Figure 13). The three bands in gynogenetic and androgenetic amur were identical to those in normal amur. Carp-amur hybrids had four distinct bands and one faint band not evident in Figure 12. The five bands corresponded with those in either carp or amur bands. General protein electropherograms also showed that gynogenetic and androgenetic amur were pure (Figure 14). The carp-amur hybrid more nearly resembled the carp than the amur although some general protein bands were identified as amur bands.

38. Electrophoresis of enzymes also showed purity of experimental progeny. The esterases (Figure 15) of gynogenetic, androgenetic, and normal amur had a single band, whereas carp and hybrids had three overlapping bands. Although the amur band migrated at the same rate as did the slowest carp band, the esterases of the two species probably

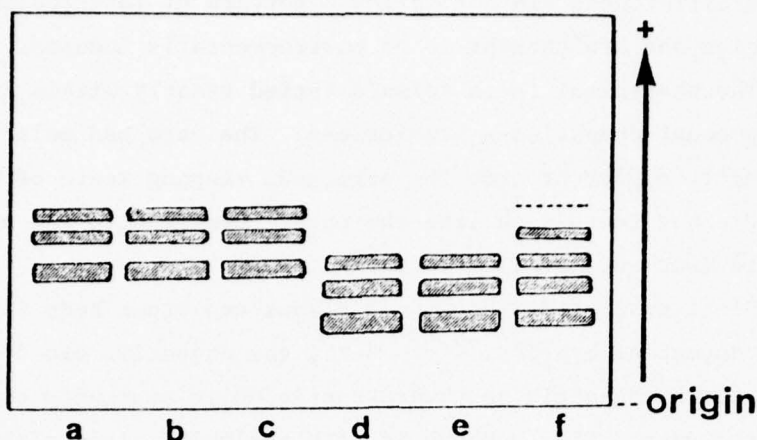


Figure 13. A tracing of hemoglobins separated by electrophoresis. Hemoglobins of different molecular structure migrated various distances depending on charge and size. These data show that amur and carp both had three hemoglobins, which were different between the two species. Hybrids had hemoglobins from both parents; whereas gynogenetic and androgenetic fish were identical to normal fish. (a) gynogenetic amur, (b) normal amur, (c) androgenetic amur, (d) normal carp, (e) gynogenetic carp, and (f) carp-amur hybrid

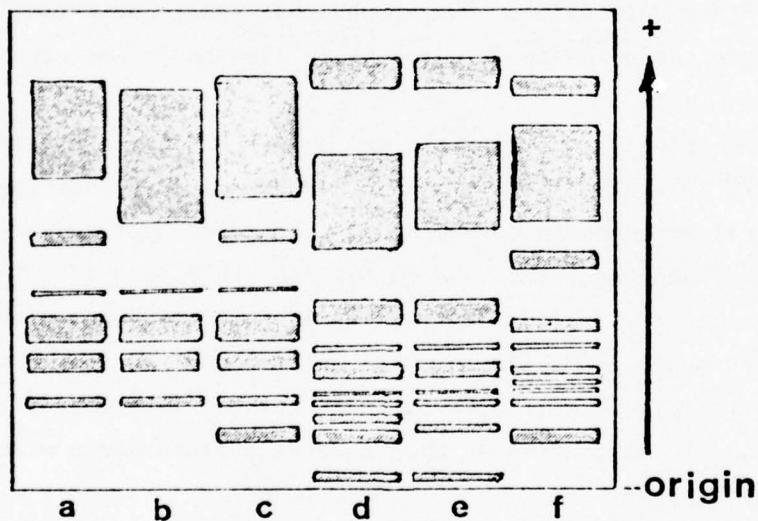


Figure 14. A tracing of the general plasma proteins separated by electrophoresis. The electropherogram shows that plasma contained many proteins. The variations between experimental fish and normal fish do not indicate inheritance from the heterologous parent. Hybrids had banding of both species and at least one band that was a hybrid molecule made from components from each parent. The legend is the same as Figure 13

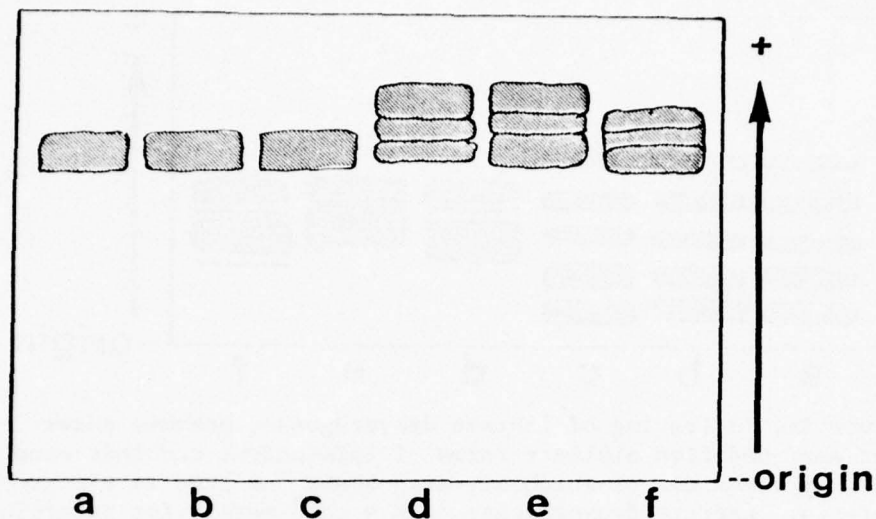


Figure 15. A tracing of esterase enzyme bands separated by electrophoresis. Amur had a single kind of esterase whereas carp had three kinds. Because carp inheritance dominated in hybrids, the absence of carp genome in gynogenetic and androgenetic amur is strongly suggested. The legend is the same as Figure 13

were molecularly different. Lactase dehydrogenase (Figure 16) in amur was composed of five bands, whereas carp and hybrids had numerous bands which migrated at the same rate. Because carp inheritance dominated in the carp-amur hybrids, the absence of the carp bands in gynogenetic and androgenetic amur strongly suggests the absence of a carp genome.

39. Comparison of chromosomes between experimental progeny was attempted. Microscopic chromosome examination was not successful, but measurement of the cell nucleus size suggested that gynogenetic, androgenetic, and normal white amur have the same chromosome number. The volume (or area as seen through a microscope) of the cell nucleus is proportionate to the number of chromosomes.<sup>48,49</sup> Nuclear area was the same in erythrocytes of the three groups of amur and was about 50 percent greater in the carp (Table 5). The carp-amur hybrid was expected to have a nuclear area intermediate between the two parental species, but the observed area was 50 percent greater. This suggested a tetraploid which would account for the hybrids being capable of reproduction.



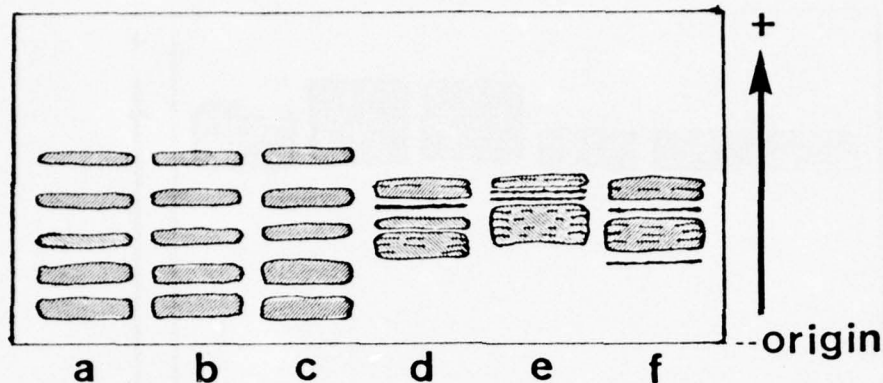


Figure 16. A tracing of lactate dehydrogenase enzymes shows that amur had five distinct forms of this enzyme and that carp had many forms all of which migrated about the same in electrophoresis. Lactate dehydrogenase was a good marker for heterologous inheritance in white amur since the presence of carp genes in the hybrid suppressed the expression of genes for the amur forms of the enzyme. The legend is the same as Figure 13

Most likely, diploid hybrids died and the relatively rare tetraploids were the sole survivors. Erythrocyte nuclear area clearly shows that both gynogenetic and androgenetic amur are diploids. This report is the first on androgenesis in which fish were diploid.

Table 5  
Erythrocyte Nuclei Area of Normal, Androgenetic, and  
Gynogenetic White Amur, Normal and Gynogenetic  
Carp, and Carp-Amur Hybrids

Form	Number of Fish	Nuclear Area ( $\mu\text{m}^2$ )*
White Amur		
Normal	14	12.4 (0.35)
Androgenetic	10	12.8 (0.29)
Gynogenetic	14	11.5 (0.29)
Carp		
Normal	14	18.3 (0.64)
Gynogenetic	1	19.8 ----
Carp X Amur		
Hybrid	10	23.5 (0.44)

Note: Standard errors are shown in parentheses.

\* Values enclosed by brackets do not differ significantly from each other, but are significantly different from values outside that bracket ( $P < 0.05$ ).

Feasibility of Producing Monosex  
Amur Fish for Operational Use

Scope

40. Several hundred thousand acres of water in the United States are infested with vegetation to the degree that some control would be desirable.<sup>50</sup> Millions of dollars are annually spent on chemicals or mechanical control programs which are usually temporary.<sup>50</sup> However, biological control is more economical and probably more permanent.

41. The white amur shows considerable promise for management of several kinds of aquatic plants.<sup>8</sup> Control of aquatic weeds can be achieved by the stocking of 20-50 fish per acre. With several hundred thousand acres, perhaps 20 million white amur could be utilized each year. It is feasible to produce this number of monosex amur. The cost of producing monosex white amur may range from a few cents to \$3.00 each, depending on whether gynogenesis or sex reversal is used and whether small or larger fingerlings are needed for stocking.

Facilities

42. Monosex white amur for weed control could be produced in a two-phase development program. Through 1977 monosex fish could be produced by gynogenesis. Existing technology suggests that between 100,000 and 200,000 monosex fish could be produced each year at an average cost of about \$3 each to control the vegetation in about 2,000 acres. In the second phase, beginning in 1977 or 1978, sex reversal techniques could be used to produce monosex fish for less than 5¢ each.

43. The cost of white amur delivered to treatment sites may vary, not only because of the difference between costs for the gynogenetic and the sex-reversed methods, but also because of the size of fingerling required. Small fish could be produced cheaply but they are vulnerable to predation by other fish and thus more are required. A computer model would be useful to predict the least cost method for achieving aquatic weed control using monosex fish. A first approximation is given in Table 6 for gynogenesis and in Table 7 for sex reversal techniques.

44. The models for weed control developed in Tables 6 and 7 have

as the principle variable the size of fingerling. In culture methods A, B, and C conventional hatchery ponds are used to grow the three sizes of fish. In culture method D, 3-in. fish are produced in hatchery ponds, then transferred to a nursery pond constructed adjacent to a lake with a weed problem, and after the fish reach 10 in., stocked by draining the nursery pond into the lake.

45. Several assumptions were made in calculating the models. Land needed was 125 percent of the pond surface area plus 40 acres.

Table 6  
Cost of Producing and Distributing Monosex (Gynogenetic)  
White Amur of Different Sizes\*

Size of Fingerlings, in.	A 3	B 5	C 10	D 10 (in nursery pond)
<u>Fingerlings Needed</u>	<u>200,000</u>	<u>150,000</u>	<u>100,000</u>	<u>100,000</u>
Capital costs (in thousands of dollars)				
Hatchery building	500	500	500	500
Wells at \$10,000 each	20	20	20	20
Land at \$1,000/acre	68	62	120	93
Pond construction	32	27	24	26
Major equipment	<u>38</u>	<u>36</u>	<u>42</u>	<u>30</u>
Totals for capital	658	645	706	669
Average (5 yr)	132	129	141	134
Annual costs (in thousands of dollars)				
Salaries	136	125	134	134
Fixed costs	28	26	28	27
Distribution costs	<u>2</u>	<u>3</u>	<u>10</u>	<u>1</u>
Totals for annual	166	154	172	162
Avg. capital and annual	298	283	313	296
Treatment cost/acre	\$149	\$142	\$156	\$148

\* A program of this size would control weeds in about 2,000 acres and would be feasible in 1975 to 1977.

Pond construction costs were \$1500 for 1 acre, \$6000 for 5 acres, \$10,000 for 20 acres, and \$50,000 for a 100-acre nursery pond. The major equipment included tractors, fish hauling trucks, and feeding equipment. Staffing included four supervisory and technical personnel, one secretary, two maintenance persons, and a varying number of semi-technical and labor personnel, depending on the quantity of fish being raised. Fixed costs were set at 17 percent of the other annual costs.

Table 7  
Cost of Producing and Distributing Monosex White Amur (Produced  
 by the Sex Reversal Technique) of Various Sizes\*

Size of Fingerlings, in.	A 3	B 5	C 10	D 10 (in nursery pond)
Fingerlings Needed, million	40	30	20	20
Capital costs (in thousands of dollars)				
Hatchery building	500	500	500	500
Wells at \$10,000 each	60	120	900	230
Land at \$1,000/acre	555	650	5040	4290
Pond construction	305	313	2009	1129
Major equipment	96	121	600	80
Totals for capital	1516	1704	9049	6229
Average (5 yr)	303	341	1810	1246
Annual costs (in thousands of dollars)				
Salaries	212	332	1300	204
Fixed costs	51	86	330	47
Distribution	20	60	200	11
Totals for annual	283	478	1830	262
Avg. capital and annual	586	819	3640	1508
Treatment cost/acre	\$1.46	\$2.05	\$9.10	\$3.70

\* Weed control could be achieved on about 400,000 acres and would be feasible by 1977 or 1978.



Distribution costs did not include salaries or truck purchase and were set at \$100 per trip for hauling 3000 lb of fish 200 miles. Overhead costs were not included. Treatment costs per acre were based on annual costs plus the capital costs prorated on a 5-year project. Relative survival was assumed to be 50 percent for 3-in., 75 percent for 5-in., and 100 percent for 10-in. fingerlings. Not included are developmental costs (\$105,000 to 1975) and costs of monitoring and gathering background data.

46. The objective of identifying the most practical procedures for producing a weed control agent was realized. For gynogenesis (Table 6) there did not appear to be much difference in costs between the four procedures. Even though the cost of \$156 per acre was higher than the other costs, model C was chosen as the most practical because weed control would be more predictable than it would when smaller fish were used. For the sex reversal technique (Table 7), the cost per acre of weed control was much less than with gynogenesis and there were considerable differences among the 4 models. The 3-in. fish gave control at a cost one-sixth that for the 10-in. fish. It was still relatively cheap to produce 5-in. fish, and these would be less vulnerable to predation, thus giving more consistent control. Method B is recommended for use in the sex reversal technique. Although these models obviously are tentative, they do allow some planning of strategy to achieve aquatic weed control at the least cost.

#### Cost-benefit

47. The cost of weed control using monosex amur produced by sex reversal is much less than that for chemical or mechanical removal. The chief advantage of biological control is that effects are more permanent than with other methods. Production of monosex fish should be only slightly more expensive than that of normal bisexual populations of male and female fish.

48. The benefits of weed control are many. Navigation on inland waters, water movement in canals,<sup>50</sup> and recreational activities such as fishing<sup>51</sup> and water skiing are all enhanced by weed control. The advantages of white amur over chemical control are costs and the gradual

removal of vegetation, thereby avoiding oxygen depletion and bursts of nutrients that often cause blooms of algae. Amur use results in gradual release of nutrients tied up in plants,<sup>52</sup> thus permitting the nutrients to be incorporated into organisms in food chains leading to desirable species of fish.<sup>53</sup> There may be some adverse effects on waterfowl or other wildlife that depend on aquatic vegetation for food,<sup>14,54</sup> but use of monosex white amur is justified because risks associated with the release of this exotic species are minimized with little change in the cost or benefits. Monosex fish would be acceptable because any damage would be temporary, and control of population size would minimize damage that does occur.

#### Operational problems

49. Several factors might affect the efficacy of white amur as a biological control agent. The most important uncertainties are:

- a. Possible "inbreeding" in gynogenesis
- b. Size-related predation by bass
- c. Emigration
- d. Effective life span

50. Because gynogenetic inheritance is entirely maternal, the genetic constitution of offspring is similar to offspring produced by sexual self-fertilization. Thus, gynogenetic progeny are highly homozygous<sup>28</sup> (genetically homogeneous), which in plants and animals generally results in reduced vigor. Growth and survival may diminish, and gynogenetic white amur may not be as effective in controlling aquatic plants as is the bisexual variety. However, females grow more rapidly than males<sup>55</sup> and probably eat more vegetation. This might offset the decreased vigor. It is speculated that if vigor deprivation occurs in gynogenesis, then the sex reversal technique is likely to give monosexes with hybrid vigor, and these should perform better than the average normally produced fish. Because gynogenesis is an interim method, the problem of reduced vigor is not a serious consideration.

51. Predation by bass and other carnivorous fishes potentially is a serious problem for economical use of white amur. White amur smaller than 8 in. are readily eaten by bass. In waters with dense

vegetation, escape may be possible and smaller fish might be stocked. In making models of production costs (Tables 6 and 7) it was assumed that 50 percent of the 3-in. fish and 25 percent of the 5-in. fish would be lost. In fact, there are no data to support such figures. Of urgent need is information on predation losses of newly stocked white amur by established fish populations.

52. Emigration of white amur from the stocking site is likely, especially as fish reach sexual maturity. The fish is adapted for river life and migrates long distances, both in its native habitat<sup>55</sup> and in the United States.<sup>54</sup> Migration is not limited to fresh water. In the Soviet Union white amur gained access to the Ural River by crossing the Caspian Sea (brackish water) from the Volga River.<sup>56</sup> Emigration has two major impacts. First, effective management of aquatic vegetation is impossible if the fish do not remain in the release area. Second, fish may congregate in waters where they are not needed and cause environmental damage. Research on fish movement is needed.

53. Of less pressing need is an estimate of the performance span of white amur for effective weed control. White amur live at least 10 years, but their capacity for vegetation consumption becomes progressively less as the fish grow older. It was observed that Najas weed reappeared in ponds after 20 amur per acre had reached a size of about 30 lb. David L. Sutton\* found similar results in Florida. Weed control for 6 years is estimated,<sup>4</sup> but regardless of the effective period, the use of amur is more economical than are other methods of weed control.

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\* Personal communication.

# REFERENCES

1. Kuronuma, K. and Nakamura, K., "Weed Control in Farm Pond and Experiment by Stocking Grass Carp," Indo-Pac. Fish. Council. Proc., Vol 7, No. 2, 1957, pp 35-42.
2. Péntzes, B. and Tölg, I., "Study of the Growth and Feeding of Grass Carp (Ctenopharyngodon idella) in Hungary," Bull. Fr. Piscic., Vol 39, 1966, pp 70-76.
3. Prikhod'ko, V. A. and Lupacheva, L. I., "The Diet of White Amur," Rybn Khoz, Vol 3, 1967, pp 58-60.
4. Stott, B. et al., "Recent Work on Grass Carp in the United Kingdom from the Standpoint of Its Economics in Controlling Submerged Aquatic Plants," Proc. Eur. Weed Res. Council. 3rd Int. Symp. Aquatic Weeds, 1971, pp 105-116.
5. Kilgen, R. H. and Smitherman, R. O., "Food Habits of the White Amur Stocked in Ponds Alone and in Combination with Other Species," Prog. Fish-Cult., Vol 33, No. 3, 1971, pp 123-127.
6. Krupauer, V., "The Use of Herbivorous Fishes for Ameliorative Purposes in Central and Eastern Europe," Proc. Eur. Weed Res. Council. 3rd Int. Symp. Aquatic Weeds, 1971, pp 95-103.
7. Michewicz, J. E., Sutton, D. L., and Blackburn, R. D., "The White Amur for Aquatic Weed Control," Weed Sci., Vol 20, No. 1, 1972, pp 106-110.
8. Gangstad, E. O., Raynes, J. J., and Burress, R. M., "Aquatic Plant Control Program; Herbivorous Fish for Aquatic Plant Control," Technical Report No. 4, Jun 1973, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.
9. Avault, J. W., Jr., "Preliminary Studies with Grass Carp for Aquatic Weed Control," Prog. Fish-Cult., Vol 27, No. 4, 1965, pp 207-209.
10. Crowder, J. P. and Snow, J. R., "Use of Grass Carp for Weed Control in Ponds," FAO Fish. Cult. Bull., Vol 2, No. 1, 1969, p.6.
11. Schneider, R. F., "Development Document for Proposed Effluent Limitations Guidelines and Standards of Performance for the Fish Hatcheries and Farms Point Source Category," Apr 1974, Environmental Protection Agency National Field Investigations Center, Denver, Colo.
12. U. S. Fish and Wildlife Service, "Injurious Wildlife, Proposed Importation Regulations," Fed. Reg., Vol 38, No. 244, Part IV, 20 Dec 1973, pp 34970-34976.
13. Courtenay, W. R., Jr., et al., "Exotic Fishes in Fresh and Brackish Waters of Florida," Biol. Conserv., Vol 6, No. 4, 1974, pp 292-302.



14. Courtenay, W. R., Jr., and Robins, C. R., "The Grass Carp Enigma," Bioscience, Vol 22, No. 4, p 210.
15. Cross, D. G., "Aquatic Weed Control Using Grass Carp," J. Fish Biol., Vol 1, No. 1, 1969, pp 27-30.
16. Opuszynski, K., "Carp Polyculture with Plant-Feeding Fish: Grass Carp (Ctenopharyngodon idella Val.) and Silver Carp (Hypophthalmichthys molitrix Val.), Bull. Acad. Pol. Sci. Ser. Sci. Biol., Vol 16, No. 11, 1968, pp 677-681.
17. Edwards, D. J., "Aquarium Studies on the Consumption of Small Animals by O-Group Grass Carp, Ctenopharyngodon idella (Val.)," J. Fish. Biol., Vol 5, No. 5, 1973, pp 599-605.
18. Schreck, C. B., "Hormonal Treatment and Sex Manipulation in Fishes," Control of Sex in Fishes, C. B. Schreck, ed., Virginia Polytechnic Institute and State University, Blacksburg, Va., 1974, pp 84-106.
19. Yamamoto, T., "Artificial Induction of Functional Sex-Reversal in Genotypic Females of the Medaka (Oryzias latipes)," J. Exp. Zool., Vol 137, No. 2, 1958, pp 227-263.
20. Yamamoto, T. and Kajishima, T., "Sex Hormone Induction of Sex Reversal in the Goldfish and Evidence for Male Heterogamety," J. Exp. Zool., Vol 168, No. 2, 1968, pp 215-221.
21. Clemens, H. P. and Inslee, T., "The Production of Unisex Broods by Tilapia mossambica Sex Reversed with Methyl Testosterone," Trans. Am. Fish. Soc., Vol 97, No. 1, 1968, pp 18-21.
22. Davis, H. S., Culture and Diseases of Game Fishes, University of California Press, Berkeley and Los Angeles, Calif., 1956, pp 92-94.
23. Fishery Ministry of the USSR, All-Union Scientific Research Institute of Pond Fishery, Manual on the Biotechnology of the Propagation and Rearing of Phytophagous Fishes, 1970, Moscow, Translated by Howland, Fish and Wildlife Service, Washington, D. C.
24. Roosevelt, R. B., "Hybrids," Proc. Am. Fish. Cult. Assoc., Vol 9, 1881, pp 8-13.
25. Romashov, D. D. and Belyaeva, V. N., "Increased Yield of Diploid Gynogenetic Loach Larvae (Misgurnus fossilis L.) Induced by Temperature Shock," Byull. Mosk. O. va. Ispyt. Prirod. otd. Biol., Vol 70, No. 5, 1965, pp 93-109.
26. Kryzhanovskii, S. G., Disler, N. N., and Smirnova, E. N., "Ecological-Morphological Regularities in the Development of Percoid Fish," Tr. Inst. Morfol. Zhivotn. Akad. Nauk., SSSR, Vol 10, 1953, pp 3-138.
27. Buss, K. W. and Wright, J. E., Jr., "Results of Species Hybridization Within the Family Salmonidae," Prog. Fish-Cult., Vol 18, No. 4, 1956, pp 149-158.

28. Purdom, C. E., "Radiation-Induced Gynogenesis and Androgenesis in Fish," Heredity, Vol 24, No. 3, 1969, pp 431-444.
29. Tsoi, R. M., "Chemical Gynogenesis of Rainbow Trout and Peled," Genetika, Vol 8, No. 2, 1972, pp 185-188.
30. Nikolyukin, N. I., "Interspecies Hybridization of Fish," Vses Nauchno-Issled. Inst. Morsk. Rybn. Khoz. Okeanogr. Sarat. otd., 1952, p 312.
31. Burlakov, A. B., Makeeva, A. P., and Ryabov, I. N., "Isozyme Composition of Hybrid and Gynogenetic Forms of Some Cyprinids at Early Stages of Ontogenesis," Biochemical Genetics of Fish, V. S Kirpichnikov, A. S. Troshin, and I. I. Fridlyanskaya, ed., Institute of Cytology, Academy of Science, USSR, Leningrad, 1973, pp 85-90.
32. Romashov, D. D. et al., "Possibilities of Producing Diploid Radiation-Induced Gynogenesis in Sturgeons," Radiobiology, Vol 3, No. 1, 1953, pp 145-154.
33. Golovinskaya, K. A., "Artificial Gynogenesis in Carp," Genetics, Selection, and Hybridization of Fish., B. I. Cherfas, ed., Academy of Sciences USSR, Moscow, 1969, pp 74-78. (Translated from Russian by R. Lavott, National Technical Information Service, Springfield, Va., 1972.)
34. Guerrero, R. D. III, The Use of Synthetic Androgens for the Production of Monosex Male Tilapia aurea (Steindachner), Ph. D. Dissertation, Auburn University, Auburn, Ala., 1974.
35. Neifakh, A. A., "Effects of Ionizing Radiation on Early Development of Fish," Tr. Inst. Morfol. Zhivotn, Akad. Nauk., Vol 24, pp 135-159.
36. Romashov, D. D. and Belyaeva, V. N., "Cytology of Radiation Gynogenesis and Androgenesis in the Loach (Misgurnus fossilis L.)," Dokl. Biol. Sci., Vol 157, No. 1-6, 1964, pp 503-506.
37. Fineman, R., Hamilton, J., and Siler, W., "Duration of Life and Mortality Rates in Male and Female Phenotypes in Three Sex Chromosomal Genotypes (XX, XY, YY) in the Killifish, Oryzias latipes," J. Exp. Zool., Vol 188, No. 1, 1974, pp 35-39.
38. Fineman, R. et al., "Length, Weight and Secondary Sex Character Development in Male and Female Phenotypes in Three Sex Chromosomal Genotypes (XX, XY, YY) in the Killifish, Oryzias latipes," J. Exp. Zool., Vol 189, No. 2, 1974, pp 227-234.
39. Norgusa, S., "A Comparative Study of the Chromosomes in Fishes with Particular Consideration on Taxonomy and Evolution," Mem. Hyogo. Univ. Agric. (Biol.), Vol 3, 1960, pp 1-62.
40. Raicu, P., Taisescu, E., and Cristian, A., "Diploid Chromosome Complement of the Carp," Cytologia, Vol 37, 1972, pp 355-358.
41. Makeeva, A. P. and Sukhanova, A. I., "Development of Hybrids of

- Phytophagous Fishes," Vopr. Ikhtiolog., Vol 6, No. 3, 1966, pp 477-497.
42. Aliev, D. S., "Morphology of Young-of-the-Year Hybrids of Phytophagous Fish," Vopr. Ikhtiolog., Vol 7, No. 1, 1967, pp 191-194.
  43. Kobayashi, S. and Mizumoto, S., "Studies on the Hybrid Ctenopharyngodon idella (Cuvier and Valenciennes) and Cyprinus carpio L.," Sci. Rep. Shiga Fish Exp. Sta., Vol 1, 1950, pp 10-13.
  44. Makeeva, A. P., "Characteristics of Embryonal and Fry Development in Hybrids of Some Pond Cyprinidae," Genetics, Selection, and Hybridization of Fish, B. I. Cherfas, ed., Academy of Sciences USSR, Moscow, 1969, pp 148-174. (Translated from Russian by R. Kavvoott, National Technical Information Service, Springfield, Va., 1972.)
  45. Makeeva, A. P. and Verigin, B. V., "Hybridization of Carp Cyprinus carpio L. with White Amur Ctenopharyngodon idella (Val.)," Vopr. Ikhtiolog., Vol 14, No. 2, 1974, pp 290-296.
  46. School, A. and Anders, F., "Tissue-Specific Preferential Expression of the Xiphophorus xiphidium Allele for 6-Phosphogluconate Dehydrogenase in Interspecific Hybrids of Platyfish (Poeciliidae, Teleostei)," Genetics and Mutagenesis in Fish, J. H. Schroder, ed., Springer-Verlag, N. Y., 1973, pp 301-313.
  47. Fritz, E. S. and Garside, E. T., "Identification and Description of Hybrids of Fundulus heteroclitus and F. diaphanus (Pisces: Cyprinodontidae) from Porters Lake, Nova Scotia, with Evidence for Absence of Backcrossing," Can. J. Zool., Vol 52, 1974, p 1433.
  48. Cherfas, N. B., "Meiotic Analysis of Unisexual and Bisexual Forms of Crucian Carp," Tr. Vses. Nauchno-Issled. Inst. Prud. Rybn. Khoz., Vol 14, 1966, pp 63-82.
  49. Cimino, M. C., "Karyotypes and Erythrocyte Sizes of Some Diploid and Triploid Fishes of the Genus Poeciliopsis," J. Fish. Res. Board Can., Vol 30, No. 11, 1973, pp 1736-1737.
  50. Frank, P. A., "Evaluation of Aquatic Herbicides," Aquatic Plant Control Program; Aquatic-Use Pattern for Silvex, Technical Report No. 5, pp E1-E12, Oct 1973, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.
  51. Walker, C. R., "Control of Certain Aquatic Weeds in Missouri Farm Ponds," Weeds, Vol 7, No. 3, 1959, pp 310-316.
  52. Stanley, J. G., "Nitrogen and Phosphorus Balance of Grass Carp, Ctenopharyngodon idella, Fed Elodea, Egeria densa," Trans. Am. Fish. Soc., Vol 103, No. 3, pp 587-592.
  53. \_\_\_\_\_, "Annual Report to U. S. Army Corps of Engineers," 1972, Fish Farming Experimental Station, Stuttgart, Ark.
  54. Greenfield, D. W., "An Evaluation of the Advisability of the

Release of the Grass Carp, Ctenopharyngodon idella, into the Natural Waters of the United States," Trans. Ill. State Acad. Sci., Vol 66, Nos. 1 and 2, 1973, pp 47-53.

55. Lin, S. Y., "Life History of Waan Ue, Ctenopharyngodon idella (C. & V.)," Lingnan Sci. J., Vol 14, No. 1, 1935, pp 129-135.
56. Verigin, B. V., "Results of Work on Acclimatization of Far Eastern Phytophagous Fishes and Measures for Their Further Assimilation and Study in New Regions," Vopr. Ikhtiol., Vol 1, No. 4, 1961, pp 640-649.



APPENDIX A: BIBLIOGRAPHY ON WHITE AMUR

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Abayer, Y. I., "On the Role of Acclimatized Herbivorous Fishes in Raising Fish Productivity of Reservoirs in the Krasnodar Territory," 1970, Trud. Vses. Nauchno-issled. Inst. Morsk. Rybn. Khoz. Okeanog. 66: 221-224.

Adamova, L. G. and G. G. Novikov, "Study of the Protein Composition of Blood Serum of Herbivorous Fish," 1973, Biol. Nauki 16(5): 44-49.

Adams, A. E. and V. Titoko, "A Progress Report on the Introduction of Grass Carp (Ctenopharyngodon idellus) in Fiji," 1970, Fiji Agri. J. 32(2): 43-46.

Ahling, B. and A. Jernelov, "Weed Control with Grass Carp in Lake Osbysjon," 1971, Swedish Water and Air Pollution Research Laboratory N.B. 94a, 24 pp.

Ahne, W., "Biological Properties of a Virus Isolated from Grass Carp (Ctenopharyngodon idella Val.)," 1975, Program Abstracts for the 3rd International Wildlife Disease Conference (in press).

Akhmerov, A. Kh., "Parasites and Disease of the Amur Fishes During Acclimatization in Pond Fisheries of the R.S.F.S.R.," 1957, Proc. of the Conf. on Fish Diseases, 9: 108-113.

\_\_\_\_\_, "Parasites and Disease of Amur Fish During Acclimatization in Pond Fisheries of the R.S.F.S.R., 1959, Trudy Soveshchanii Ikhtiologicheskoi Komissii Akad. Nauk. SSSR, No. 9.

Alabaster, J. S. and B. Stott, "Grass Carp (Ctenopharyngodon idella Val.) for Aquatic Weed Control," 1967, Proc. Eur. Weed Res. Council 2nd Int. Symp. on Aquatic Weeds, pp 123-126.

Al-Husseini, A. H., "On the Functional Morphology of the Alimentary Tract of Some Fish in Relation to Differences in Their Feeding," 1949, Quart. J. Micro. Sci. 90: 109-139, 324-354.

Aliev, D. S., "Amur and Tolstolobik in Turkmenia," 1961, Rybovod. Rybolov. 5:14-16.

\_\_\_\_\_, "Experience on the Production of Progeny from Far Eastern Phytophagous Fishes Under Turkmenian Conditions," 1961, Vopr. Ikhtiol. 1(4):649-658 (in Russian).

Aliev, D. S., "Experience in the Use of White Amur in the Struggle Against the Overgrowth of Water Bodies," 1963, In: Problems of the Fisheries Exploitation of Plant-Eating Fishes in Waters of the USSR. Akademiya Nauk Turkmenk SSR, pp 203-209.

\_\_\_\_\_, "Breeding of White Amur (Ctenopharyngodon idella), Silver Carp (Hypophthalmichthys molitrix) and Bighead Carp (Aristichthys nobilis) in the Amu-Darya Basin," 1965, Vopr. Ikhtiolog. 5(4):593-599.

\_\_\_\_\_, "Fishes as Meliorators of Reservoirs," 1965, Priroda 54(8):56-60 (translated).

\_\_\_\_\_, "Morphology of Young-of-the-Year Hybrids of Phytophagous Fish," 1967, Vopr. Ikhtyol. 7(1):191-194 (in Russian).

\_\_\_\_\_, "Basic Aspects of the Biological Technique of the Artificial Propagation of Phytophagous Fishes Under Production Conditions," 1968, In: New Research on the Ecology and Propagation of Phytophagous Fishes. Nauka, Moscow, edited by G. V. Nikolskii.

Aliev, D. S. and R. Y. Bessmertnaya, "Use of the Grass Carp (Ctenopharyngodon idella Val.) to Control the Larvae of Blood-Sucking Mosquitoes," 1968, Probl. Ikhtiolog. 8(2):395-397.

Aliev, D. S. and A. I. Sukhanova, "Fecundity of the Grass Carp, Ctenopharyngodon idella (Val.) and the Silver Carp Hypophthalmichthys molitrix (Val.) in the Karakum Canal and Its Reservoirs," 1974, Izv. Akad. Nauk. Turkmenk SSR Ser. Biol. Nauk. 4:77-83.

Aliev, D. S., A. I. Sukhanova, and R. E. Muravleva, "Biological Bases for the Farming of Herbivorous Fish and Their Use for Biological Weed Control," 1973, In: Ichthyological Investigations on the Mezhdunarodnoi Biological Program, Nechaeva, N. T. et. al (eds.) Akad. Nauk. Turkmenk SSR, Ashkhabad, 102-110.

Alikunhi, K. H. and K. K. Sukumaran, "Preliminary Observations on Chinese Carp in India," 1964, Proc. Ind. Acad. Sci., B. 60(3):171-189.

Alikunhi, K. H., K. K. Sukumaran, and S. Parameswaran, "Induced Spawning of the Chinese Grass Carp, Ctenopharyngodon idellus (C. and V.), and the Silver Carp, Hypophthalmichthys molitrix (C. and V.) in Ponds at Cuttack, India," 1962, Proc. Indo-Pacif. Fish. Council. 19:181-204.

\_\_\_\_\_, "Induced Spawning of the Chinese Carps Ctenopharyngodon idellus (C. and V.) and Hypophthalmichthys molitrix (C. and V.) in Ponds at Cuttack, India," 1963, Current Sci. 32:103-106.

\_\_\_\_\_, "Observations on Growth, Maturity and Breeding of Induced-Bred, Pond-Reared Silver Carp, Hypophthalmichthys molitrix and Grass

Carp, *Ctenopharyngodon idellus* in India During July, 1962 to August, 1963," 1965, Bull. Central Institute of Fisheries Education, Bombay, 2:1-19.

Anderson, E. N., Jr., "Traditional Aquaculture in Hong Kong," 1970, J. Trop. Geogr. 30:11-16.

Andriasheva, M. A., "Some Results of Inter-Generic Hybridization of Phytophagous Cyprinids," 1966, ISV. Gosud. Nauchno.-issled. Inst. Ozer. Rech. Rybn. Khoz. 65.

\_\_\_\_\_, "Some Results Obtained by the Hybridization of Cyprinids," 1968, In T.V.R. Pillay (ed.), FAO Fish. Rep. No. 44 Vol 4: 205-214.

Andrievskaya, S. A., N. I. Bogdanov, F. A. Akhrorov and A. Khaitov, "Data on the Hydrobiology of Fish Ponds of Southern Tadzhik SSR," 1973, Izv. Akad Nauk Tadzh. SSR Otd. Biol. Nauk 2:73-76 (in Russian).

Anishchenko, I., "Acclimation of Amur Fishes in the European Part of the U.S.S.R.," 1939, Rybn. Khoz. 5:33-35.

Anon., "Rearing Chinese Carp Fry for Stocking Fattening Ponds," 1949, Fish. Bull., Singapore (2) 5 pp.

Anon., "Report of the Subcommittee on Fisheries," 1961, Proc. 10th Pacif. Sci. Congr., Honolulu, 227 pp.

Anon., "Chinese Fry," 1967, Nature, London. 215(5105):1021, p 30.

Anon., "The Control of Aquatic Weed by Grass Carp," 1968, Minist. Agric. Fish. Fd. Salmon & Freshwater Fisheries Res. Prog. Rep. 13-14.

Anon., "Manual on the Biotechnology of the Propagation and Rearing of Phytophagous Fishes," 1970, All-Union Scientific Research Institute of Pond Fisheries, Moscow 72 pp (translated).

Anon., "The Use of Herbivorous Fish in Fish Farming and in the Weeding of Reservoirs," 1970, Vest. Akad. Nauk SSR 1970 (11)26-30.

Anon., "North American Reproduction of Grass Carp," 1975, Sport Fishing Inst. Bull. (269):5.

Antalfi, A and I. Tölg, "Biological Control of Aquatic Plants (Biologische Berkämpfung der Wasserpflanzen)," 1968, Allgem. Fischerei-Ztg. 93(6):167-170.

Antalfi, A and L. Tölg, "Herbivorous Fish.," 1968, Mezőgazdasági Kiadó. Budapest, 156 pp.

- Anwand, K., "Gefrier- und Gefrierlagerungsversuche mit Graskarpfen," 1970, Dt. Fischerei-Ztg. 17:350-351.
- Anward, K. and R. Seegar., "Rohwaren- und Gebrauchswerteigenschaften des Graskarpfens," 1971, Z. Binnenfischerei DDR 18(8):218-224.
- Aoki, M., "Grass Carp Culture," 1953, Suisankai, 828:54-65 (in Japanese).
- Araki, K., "On Grass Carp and Its Propagation Recommended by Ministry of Agriculture and Forestry," 1943, Norinjiho 3(5):15-20 (in Japanese).
- Astakhova, T. V. and G. A. Stepanova., "Parasite Fauna of Ctenopharyngodon idella from Pond- and Spawning-Nursery Fisheries in the Volga Delta," 1972, Parazitologiya 6(4): 364-368.
- Avault, J. W., Jr., "Biological Weed Control with Herbivorous Fish," 1965, Proc. 18th Southern Weed Control Conf. 1965:590-591 (Abstract).
- \_\_\_\_\_, "Preliminary Studies with Grass Carp for Aquatic Weed Control," 1965, Prog. Fish-Cult. 27(4):207-209.
- Avault, J. W., Jr., R. O. Smitherman and E. W. Shell., "Evaluation of Eight Species of Fish for Aquatic Weed Control," 1968, FAO Fish Rept. 44:Vol 511/E-3:109-122.
- Babaev, B. and A. J. Shcherbakova., "The Control of Bothriocephalus gowkongensis from Ctenopharyngodon idella (Valencinnes)," 1963, Izv. Akad. Nauk. Turkmensk. SSR (Biol.) 4:86-87.
- Babayan, K. E., "Some Results of Acclimation of Phytophagous Fish to Fish-Farm Conditions in Reservoirs of USSR," 1962, Rybn. Khoz. 38(12): 23-27.
- \_\_\_\_\_, "A New Stage in the Culture of Plant-Eating Fishes," 1966, Rybn. Khoz. 42(6):4-7, Transl. W. E. Ricker Fish. Res. Bd. Canad. Transl. Ser No. 714.
- \_\_\_\_\_, "A New Stage in the Breeding of Herbivorous Fish," 1968, In: New Research on the Ecology and Propagation of Phytophagous Fishes, Nauha, Moscow (Ed. G. V. Nikolskii) pp. 5-11 (in Russian).
- Bailey, B., "Commercial Fisheries in Arkansas," 1974, Proc. 4th Inland Commer. Fish. Workshop, pp 22-24.
- Bailey, W. M. and R. L. Boyd, "A Preliminary Report on Spawning and Rearing of Grass Carp (Ctenopharyngodon idella) in Arkansas," 1970, Proc. Annual Conf. S.E. Assoc. of Game and Fish Commissioners, Atlantic, Ga., 24:560-569.



Bailey, W. M. and R. L. Boyd, "Some Observations on the White Amur in Arkansas," 1972, Hyacinth Control J., 10:20-22.

Baker, G. E., D. L. Sutton, and R. D. Blackburn, "Feeding Habits of the White Amur on Waterhyacinths," 1974, Hyacinth Control J., 12: 58-62.

Balon, E. K., "Finding of Ctenopharyngodon idella (Valenciennes, 1844) in the Main Stream of the Danube at Kilometer 1749," 1968, Vestn. Cesk. Spolecnosti Zool. 32(2): 97-103.

Banarescu, P., "Fauna Republicii Populare Romine, Bucuresti," 1964.

Bardach, J. E., J. H. Ryther and W. D. McLarney, "Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms," 1972, Wiley-Interscience New York, 868 pp.

Bardach, J. E., et al., "The Status and Potential of Aquaculture, Particularly Fish Culture, Vol 2 Part 1, The Status and Potential of Aquaculture, Part III, Fish Culture," PB 177:768.

Batenko, A. I., and Z. F. Sorokhina, "Fish Rearing as a Method of Controlling Weeds in Rice Paddies," 1969, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 16:204-206.

Bauer, O. N., "Control of Carp Diseases in the USSR," 1968, FAO Fish. Rep. 44(5).

Bauer, O. N. and B. Babaev., "Sinergasilus major (Markewitsch) Its Biology and Pathogenic Significance," 1963, Izv. Akad. Nauk. Turkmen. SSR (biol.) 3:63-67.

Bauer, O. N., B. Babaev, and Yu. A. Strelkov., "Parasitic Infections of White Amur and Tolstolobik When Rearing in Ponds," 1963, In: Problems of Parasitology. Studies of the 4th Scientific Conference on Parasitology USSR, Kiev, Akad. Nauk Ukrainsk. SSR. pp. 439-440.

Bauer, O. N., V. A. Musselius and J. A. Strelkov., "Die Parasiten und Krankheiten von Ctenopharyngodon idella, Hypophthalmichthys molitrix und Aristichthys nobilis bei der Aufzucht in Teichwirtschaften der Ud SSR," 1969, Z. Fisch. 17(1-4):205-213.

Bauer, O. N. and J. A. Strelkov, "Diseases and Parasites of Fry of the Far-East Fish During its Quarantine Period," 1963, Izv. Akad. Nauk. Turkmen. SSR (biol.) 3:150-153.

Behrendt, A., "Angling Clubs Report of Grass Carp as a Weed Control," 1973, the two lakes 5th fisheries management training course report. 89-94.

- Belopolskii, M. P., O. B. Maksimov, and E. A. Lagovskaya, "The oil of Freshwater Fish," 1936, Vestnik Dalnevostochnogo Filiala Akad. Nauk. SSSR. Vladivostok. No. 16:47-65.
- Berg, L. S., "Freshwater Fishes of the U.S.S.R. and Adjacent Countries," 1949, Vol II, Izdatel'stvo Akademii Nauk SSSR, Moskva-Leningrad 496 pp. Transl. by O. Ronen, Office of Technical Services, Washington, D. C.
- Beridze, I. O. and R. I. Chkhaidze, "Some Aspects of the Acclimation of Herbivorous Fishes in Georgia," 1966, Ref. Zh. Biol. No. 3R175. Biol. Abs. 1967, No. 94337.
- Berry, P. Y. and M. P. Low, "Comparative Studies on Some Aspects of the Morphology and Histology of Ctenopharyngodon idellus, Aristichthys nobilis, and their Hybrid (Cyprinidae)," 1970, Copeia 1970(4):708-726.
- Bessmertnaya, R. Ye., "Aspects of the Nutrition of Grass Carp Larvae," 1968, In: New Research on the Ecology and Propagation of Phytophagous Fishes, edited by G. V. Nikolskii, Nauka, Moscow.
- Bezklubov, G. A., "Embryonic Development of Grass Carp (Ctenopharyngodon idella Val.) Acclimatized in the Southern Ukraine," 1968, Ryb. Khoz. Resp. Mezhd. Temat. Nauch SB (4): 42-45.
- Bhatia, H. G., "Grass Carps Can Control Aquatic Weeds," 1970, Ind. Fmg. 20(2):36-37.
- Bhimachar, B. S. and S. D. Trepatri, "A Review of Culture Fisheries Activities in India," 1967, FAO Fisheries Rept. 44(2):1-33.
- Birtwistle, W., "Rearing of Carp in Ponds," 1931, Malay. Agrics. J. 19(8):372-383.
- \_\_\_\_\_, "Transport of Carp Fry from China," 1931, Malay. Agric. J. 19(10):490-493.
- Bisseru, B., "Clonorchis sinensis in West Malaysia," 1970, Trop. Geogr. Med. 22:352-356.
- Bizyaev, I. N. and T. V. Chesnokova, "Experiments on Rearing Phytophagous Fishes on Rice Fields," 1966, Rybn. Khoz. 42(3):19-20.
- Bizyaev, I. N. and Yu. M. Motenkov., "Acclimatization of Grass Carp and Silver Carp in the Open Waters of the Azov-Kuban Region," 1964, Trud. Vses. Nauch-issled Inst. Morskogo Rybn. Khoz. Okeanogr. 55: 125-132.
- Blackburn, R. D. and D. L. Sutton, "Growth of White Amur (Ctenopharyngodon idella (Val.)) on Selected Species of Aquatic Plants," 1971, Proc. Eur. Weed Res. Counc. 3rd Int. Symp. Aquatic Weeds, Oxford, 87-93.

Blackburn, R. D., D. L. Sutton and T. Taylor, "Biological Control of Aquatic Weeds," 1971, J. Irrigation and Drainage Div. Proc. Soc. Civil Engineers, 97: 421-432.

Bobrova, Yu. P., "Experimental Rearing of 2- and 3-Summer Grass Carp in Association with 2-Summer Carp in the Moscow Region," 1965, Trud. Vses. Nauch.-issled. Inst. Prud. Rybn. Khoz. 13: 41-45.

\_\_\_\_\_, "Rearing Phytophagous Fish Together With Carp," 1965, Rybovod. Rybolov. 5.

\_\_\_\_\_, "The Rearing of Grass Carp in Polyculture With Other Fishes in Ponds of the Moscow Region," 1967, Trud. Vses. Nauch.-issled. Inst. Prud. Rybn. Khoz. (14): 3-14.

\_\_\_\_\_, "The Development of Gonads of the Grass Carp Raised in Ponds in the Central Zone of the Russian Federation," 1968, In: Problems in Pond Pisciculture, Transl. by Fish. Res. Bd. Can. Trans. Ser. No. 1155.

\_\_\_\_\_, "The Diet and Growth of Grass Carp in Fish Ponds of the Central Russian Republic," 1968, In: G. V. Nikolskii (ed.) New Research on the Ecology and Propagation of Phytophagous Fishes, pp 106-116, Nauk, Moscow.

\_\_\_\_\_, "On Development of the Gonads and the Process of Fertilization in the White Amur," 1969, pp 123-128, In: Genetics, Selection and Hybridization of Fish, B. I. Cherfas (ed.) Akad. Nauk. SSSR. Transl. by National Marine Fisheries Service, National Technical Information Service, Springfield, VA.

\_\_\_\_\_, "Hibernation of Grass Carp on Fish Farm 'Yakot'," 1971, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 19:71-74.

Bogdanova, G. I. and N. I. Bogdanov, "Some Results of Rearing Fish in Ponds of Southern Tadzhik SSR," 1973, Izv. Akad. Nauk. Tadzh. SSR Otd. Biol. Nauk. 3:52-57 (in Russian).

Bogdanovich, O. I., "Dynamics of the Abundance and Biomass of Bacteria in Soils of Ponds in the Fish Farm 'Karamet-Niyaz': and the Karakum Canal," 1970, Gidrobiol. Zh. 6:16-22 (English summary).

Bohl, M., "Initial Experience with the Grass Carp (Ctenopharyngodon idella) at Wielenbach," 1967, Allg. Fisherei-Ztg. 92(21):657-660.

\_\_\_\_\_, "The Pond Management Significance of Aquatic Plants and Possibilities of Controlling Them Under Special Consideration of the Chinese Phytophagous Fishes," 1971, Wasser-und Abwasser-Forschung-NR 3/71 8 pp. Transl. from German.

Borutskii, Ye. V., "Materials of the Food of White Amur (Ctenopharyngodon idella (Val.) and Small-Scaled Yellowfin (Plagionathops microlepis (Bl.) in the Basin of the Amur," 1952, Trud. Amur. Ichthyological Expedition 1955-1949, Vol III pp 505-511.

\_\_\_\_\_, "Methods of Studying the Feeding of Herbivorous Fish," 1955, Trudy Soveshchaniya po Metodike Izucheniya Kormovoi Bazy i Pitaniya Ryb., 54-61.

Boyadzhiev, A., "The Problem of Feeding 2- and 3-Year Old Grass Carp," 1970, Izv. Stantsiyata Sladkovodno Ribarstvo, 7:77-87.

Britchuk, P. F., "Cryptobia cyprini Plehn, 1903. (Flagellata, Bodonidae) as a Cause of Mortality of Ctenopharyngodon idella Val.," 1969, Parazitologiya 3:574-576 (English summary).

Burlakov, A. B., A. P. Makeeva and J. N. Ryabov, "Isozyme Composition of Hybrid and Gynogenetic Forms of Some Cyprinids at Early Stages of Ontogenesis," 1973, In: Biochemical Genetics of Fish, V. S. Kirpichnikov, A. S. Troshin, and I. I. Fridlyanskaya (eds.), pp 85-90, Institute of Cytology Akad. Nauk SSSR, Leningrad.

Burress, R. M., "Current Status of Research on the White Amur in North America," 1972, Proc. 25th Annual Meeting Southern Weed Sci. Soc. 25:390.

Busnita, Th, "Results Concerning the Acclimatization of the Chinese Fishes in Rumania," 1964, Wasser und Abwasser-Beiträge zur Gewässerforschung 4:218-225.

Chapman, V. J., "A History of the Lake-Weed Infestation of the Rotorua Lakes and the Lakes of the Waikato-Hydro-Electric System," 1970, Inf. Series New Zealand Dep. Scient. Ind. Pres. 78:52.

Chapman, V. J. and B. J. Chapmen, "Experiments With Grass Carp in Controlling Exotic Macrophytes in New Zealand," 1971, Hidrobiologia 12: 313-323.

Charyev, R. and D. S. Aliev, "Experiments on the Utilization of Grass Carp for the Control of Water Weeds in Carp Rearing Ponds," 1966, In: Fisheries Exploitation of Phytophagous Fishes, Nauka, Moscow, 77-82.

Chaudhuri, H., S. B. Singh and K. K. Sukumaran, "Experiments on Large-Scale Production of Fish Seed of the Chinese Grass Carp, Ctenopharyngodon idellus (C. & V.) and the Silver Carp, Hypophthalmichthys molitrix (C. & V.) by Induced Breeding in Ponds in India," 1965, Proc. Indian Acad. Sci. 63:(sec. B): 80-95.



Chaudhuri, H., S. B. Singh, K. K. Sukumaran, P. C. Chakrabarti, "Notes on Natural Spawning of Grass Carp and Silver Carp in Induced Breeding Experiments," 1967, Sci. and Cult. 33:493-494.

Chen, Chin-leu, "The Protozoan Parasites from Species of Chinese Pond Fishes. The Protozoan Parasites of Ctenopharyngodon idella," 1955, Acta Hydrobiol. Sinica 2.

Chen, C. S. and M. L. Chen, "A Survey on Pond Culture in Kiangsu, Chekiang and Kiangsi Fisheries," 1922, Bull. Kiangsu Provincial School, 4 pp.

Chen, C. S. and S. Y. Lin, "The Fish Fry Industry of China," 1935, Bull. Chekiang Prov. Fish. Exp. Sta. 1(4):38-42.

Chen, F. Y., M. Chow, and B. K. Sim, "Induced Spawning of the Three Major Chinese Carps in Malacca, Malaysia," 1969, Malaysian Agric. J. 47(2):211-238.

Chen, F. Y. and B. K. Sim, "The Use of Triple Superphosphate as a Fertilizer in the Chinese System of Fish Culture in Malaya," 1967, T.F.C.R. I. Annual Rep., 32-40.

Chen, Nin-Shen and Tsiun-fan Shi, "Oxygen Consumption by the Grass Carp, Silver Carp, and Bighead," 1955, Rybn. prom-st za rubezhom, sb 4, translated from an article from Vest. Zool. 7: No. 1 (in Chinese).

Chen, T. P., "A Preliminary Study on Association of Species in Kwangtung Fish Ponds," 1934, Lingnan Sci. J. 13(2):275-283.

\_\_\_\_\_, "Efficiency Factors of Certain Fish Foods With Reference to Association of Species," 1935, Lingnan Sci. J. 14:621-626.

Ceng-nan, Y., and C. Fang-lang, "Ctenopharyngodon idella Val's Digestion of High Grade Carbohydrates," 1949, Jap. J. of Aquatic Products 15(6):259-261.

Cherfas, B. I., "Fish Culture in Natural Waters, 1956, Moscow, Pishcherfriomizdat, 468 pp.

Chiba, K., "Density of Stocking in Fresh Water Culture," 1965, Aquiculture, Tokyo, Special issue, 43-46 (in Japanese).

Chimits, P., "Les Carpes Chinoises," 1958, Bull. Fr. Piscic. 31:84-91.

Chizhov, N. I. and A. E. Anoshin, "Fish Culture on Rice Fields Under Water Fallow," 1969, Trudy Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 16:187-193.

Chizhov, N. I. and V. F. Demyanenko, "Fish Farming Rice Paddies Under Water Fallow in Order to Improve Them," 1972, In: Acclimatization of Herbivorous Fish in Reservoirs of the USSR, M. F. Varoshenko (ed.) Kishinev, 136-139.

Chokder, A. H. "Biological Control of Aquatic Vegetation," 1967, Agriculture, Pakistan 18(2):225-229.

\_\_\_\_\_, "Further Investigations on Control of Aquatic Vegetation in Fisheries," 1968, Agriculture, Pakistan 19(1):101-118.

Chow, T., "Growth Characteristics of Four Species of Pond Fish in Hong Kong," 1958, Hong Kong Univ. Fish. Jour. 2:29-36.

Chu, T. Y., "Comparative Studies on the Scales and on the Pharyngeals and Their Teeth in Chinese Cyprinids," 1935, Biol. Bull. St. John's Univ., Shanghai 2:1-225.

Chung, L. et. al., "Freshwater Fish Culture in China," 1961, Scientific Publications, Peking, 73-132 (in Chinese).

Ciborowska, J., "Food of Grass Carp (Ctenopharyngodon idella Val.), Silver Carp (Hypophthalmichthys molitrix Val.) and Big Head Carp (Aristichthys nobilis Rich.) in the Polyculture With Carp Fry," 1973, Roczn. Nauk Roln. Ser. B. Zootech.

Courtenay, W. R. and C. R. Robins, "The Grass Carp Enigma," 1972, BioScience 22(4):210.

\_\_\_\_\_, "Exotic Organisms: An Unsolved Complex Problem," 1975, BioScience 25(5): 306-313.

Cristea, A., E. Criztea, N. Ionescu and E. Jora, "Inducing Spawning in Grass Carp (Ctenopharyngodon idella) at the Perisov Hatchery (Danube Delta) in 1968," 1969, Bul. Inst. Cercet. Pisc. 28(1):33-45.

Cross, D. G., "Aquatic Weed Control Using Grass Carp," 1969, J. Fish. Biol. 1:27-30.

\_\_\_\_\_, "The Tolerance of Grass Carp, Ctenopharyngodon idella (Val.) to Seawater," 1970, J. Fish. Biol. 2(3):231-233.

Crowder, J. P. and J. R. Snow, "Use of Grass Carp for Weed Control in Ponds," 1969, FAO Fish. Cult. Bull. 2(1):6.

Cumming, K. B., R. M. Burress, and P. A. Gilderhus, "Controlling Grass Carp (Ctenopharyngodon idella) with Antimycin, Rotenone, and Thanite and by Electrofishing," 1975, Prog. Fish. Cult. 37(2):81-84.

Cure, Victoria, "The Development of Grass Carp (Ctenopharyngodon idella Val.) in Frasiniet Pond," 1970, Bul. Inst. Cercet. Piscic. 29(3):31-51.

\_\_\_\_\_, "The Modification of Biocenosis after Introducing the Grass Carp (Ctenopharyngodon idella Val.) in the Pond Frasiniet (district ilfov)," 1971, Stud. Cercet. Piscic. Inst. Cercet Proiect Aliment 4:3-58.

\_\_\_\_\_, "The Improvement of the Ecological Conditions in Frasiniet Pond-Intensely Overrun by Macrophytes After Having Stocked it with Grass Carp (Ctenopharyngodon idella (Val.)), " 1974, Arch. Hydrobiol. Supplement B. 44(3):338-351 (in German).

Cure, V., A. Snaider and I. Chiosila, "Macrophytes from the Frasiniet Pond (Ilfov province) and Their Influence on the Life of the Eco-system Two Years After the Introduction of the Species Ctenopharyngodon idella," 1970, Bul. Inst. Ceret. Pisc. 29:5-27.

Damit, H. bin Awang, "Fresh Water Fish Culture Trial, Brunei State," 1961, Tech Pap. Indo.-Pacific Fish Counc. 16:2 p.

Danecker, E., "Plant-Eating Fish," 1966, Österreichs Fischerei 19(10):146-151.

Davey, R. B., M. V. Meisch, D. L. Gray, J. M. Martin, K. E. Sneed, and F. J. William, "Various Fish Species as Biological Control Agents for the Dark Rice Field Mosquito in Arkansas Rice Field," 1974, Environ. Entomol. 3(5):823-826.

Dean, W., "The Great Carp Controversy: Superfish or Super Menace?" 1972, Commerce 69(4):41-44.

Degtyarev, G. V., "Duration of Food Movement Along the Digestive Canal of Two Year Ctenopharyngodon idella Val.," 1968, Gidrobiol. Zh. 4(6):60-61.

Demyanko, V. F., "The Importance of the Grass Carp in Rice Field Reclamation," 1971, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 18: 57-62.

DeZylva, E.R.A., "Fish Farming in Malaya," 1952, Colombo, Ceylon Government Press, 9 pp.

Diarova, G. S., "The Parasitic Fauna of the Grass Carp and Common Carp Obtained from Hatcheries and Cultured in Pond Farms of Southern Kazakhstan," 1971, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 18:63-65.

Dimitrov, M., "New Methods for the Intensification of Carp Breeding in Bulgaria," 1968, Dt. Fischerei Ztg. 15(5):140-143.

- Dimitrov, M. and Z. Lyudskonova, "Influence of Ctenopharyngodon idella Val. on Carp Pond Productivity," 1970, Izv. Stancijata Sladkovdno ribarstvo, 7:45-64.
- Dogel, V. A. and A. Kh. Akhmerov, "Parasitic Crustaceans of Amur Fishes," 1952, Zoologiya, pp 268-294.
- Doroshev, S. I., "Survival of Young Grass Carp (Ctenopharyngodon idella) and Silver Carp (Hypophthalmichthys molitrix) in Waters of Various Salinities From the Azov and Aral Sea," 1963, In: Problems of the Fisheries Exploitation on Phytophagous Fishes in Waters of the USSR. Akad. Nauk. Turkmensk SSR, Ashkhabad pp 144-149.
- Dubitskiy, A. M. and V. I. Rusinov, "The Use of Fishes for Mosquito Control in Southeastern Kazakhstan," 1968, Kazakh. Acad. Sci., Alma-Ata.
- Dukrovetz, G. M., "White Amur in the Ili River Basin," 1972, Izv. Akad. Nauk. Kaz. SSR Ser Biol. 1:52-57.
- Duthu, G. S. and R. H. Kilgren, "Aquarium Studies on the Selectivity of 16 Aquatic Plants as Food by Fingerling Hybrids of the Cross Between Ctenopharyngodon idella Male and Cyprinus carpio Female," 1975, J. Fish. Biol. 7(2): 203-208.
- Edwards, D. J., "Aquarium Studies on the Consumption of Small Animals by O-Group Grass Carp, Ctenopharyngodon idella (Val.)," 1973, J. Fish. Biol. 5(5):599-605.
- \_\_\_\_\_, "Weed Preference and Growth of Young Grass Carp in New Zealand," 1974, N. Z. J. Mar. Freshwater Res. 8(2): 341-350.
- Edwards, D. J. and P. M. Hine, "Introduction, Preliminary Handling, and Diseases of Grass Carp in New Zealand," 1974, N.Z.J. Mar. Freshwater Res. 8(3): 441-454.
- Ellis, J. E., "Observations on the Jumping and Escapement of White Amur," 1974, Prog. Fish-Cult. 36(1):15.
- Erokhina, L. V., G. I. Savin and A. D. Kondradt, "On the Method of Artificial Reproduction of Phytophagous Fishes," 1966, In: Fisheries Exploitation of Phytophagous Fishes. G. V. Nikolskii (ed.) Nauka, Moscow, 17-29.
- FAO/UN, "Report to the Government of the Republic of China on the Production of Fry and Fingerlings of Chinese Major Carps by Induced Spawning," 1965, Rep. FAO/EPTA 92(44):12 pp.
- Fielding, J. R., "New Systems and New Fishes for Culture in the United States," 1968, FAO Fish. Rep. 44(5):143-161.



Filatov, V. I. and D.-T. Hing, "Mixed Culture of Herbivorous Fishes and Carps in the Central Regions of the USSR," 1971, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 18:213-217.

Fischer, Z., "Food Selection in Grass Carp (Ctenopharyngodon idella Val.) Under Experimental Conditions," 1968, Polskie Arch. Hydrobiol. 15:1-8.

\_\_\_\_\_, "The Elements of Energy Balance in Grass Carp (Ctenopharyngodon idella Val.)," 1970, Pol. Arch. Hydrobiol. 17(4):421-434.

Fischer, Z., "The Elements of Energy Balance in Grass Carp (Ctenopharyngodon idella Val.) Part II: Fish Fed With Animal Food," 1972, Pol. Arch. Hydrobiol. 19(1):65-82.

\_\_\_\_\_, "The Elements of Energy Balance in Grass Carp (Ctenopharyngodon idella Val.) Part III: Assimilability of Proteins, Carbohydrates, and Lipids by Fish Fed With Plant and Animal Food," 1972, Pol. Arch. Hydrobiol. 19(1):83-95.

\_\_\_\_\_, "The Elements of Energy Balance in Grass Carp (Ctenopharyngodon idella Val.) Part IV: Consumption Rate of Grass Carp Fed on Different Types of Food," 1973, Pol. Arch. Hydrobiol. 20(2):309-318.

Fischer, Z. and V. P. Lyakhnovich, "Biology and Bioenergetics of Grass Carp (Ctenopharyngodon idella Val.)," 1973, Pol. Arch. Hydrobiol. 20(4):521-557.

Fukushima, Y., "Chinese Fish Culture," 1965, Aquiculture, Tokyo, March 1965 (in Japanese).

Gaevskaya, N. S., "The Role of Higher Aquatic Plants in the Nutrition of the Animals of Freshwater Basins," 1969, Vol. 1, Chapter 1 and 2, pp 148-159 (translated from the Russian).

Gaudet, J. L., "The Status of Warm-Water Pond Fish Culture in Europe," 1967, FAO Fish. Rep. 44(2):70-87.

Gerbil'skii, N. L., "Method of Pituitary Injections and its Role in the Reproduction of the Fish Reserve," 1941, Sborn. Leningr. Gos. Univ. 5-35 (in Russian).

\_\_\_\_\_, "The Degree of Influence of Gonadotropic Pituitary Hormone and Some Associated Details in Application of Pituitary Injections in Fisheries," 1959, Acta Hydrobiol. Sinica 4:489-509 (in Russian).

\_\_\_\_\_, "The Present State of the Question of Neurohumoral Regulation of the Sexual Cycle in Fishes and the Biological Techniques of Hormonal Stimuli in Fish Breeding as Applied to Phytophagous Fishes," 1966, In: Material of the 7th Session of the Joint Commission

on Application of the Convention on Fishing in Danubian Waters, Kiev.

Gidumal, J. L., "A Survey of the Biology of the Grass Carp, Ctenopharyngodon idellus (C. & V.)," 1958, Hong Kong Univ. Fish J. 2:1-6.

Giurca, R., "Investigations on RNA Quantitative Dynamics in Pituitary Gland and Gonads from the Grass Carp (Ctenopharyngodon idella (Val.) Pisces, Osteichthyes, Cyprinidae) Depending on Ovary Maturity Stage," 1970, Bul. Inst. Cercet. Piscic. 29(4): 13-19.

\_\_\_\_\_, "Contributions to the Comparative Study of the Seasonal Biorhythm of Gonads and Pituitary Nucleic Acids in Ctenopharyngodon idella (Val.) Reared in Ponds or Living in Natural Waters," 1973, Bul. Cercet. Piscic. 31(1/2):45-54.

Giurca, R. and C. Radulascu, "Investigations on the Seasonal Variations of RNA and DNA in the Pituitary and Gonads of Grass Carp (Ctenopharyngodon idella)," 1971, Bul. Inst. Cercet. Pisc. 30(2):57-86.

Glagolev, E. W., "Some Information on Aquatic Weed Control of Heated Water and Their Fisheries Utilization," 1963, In: Problems of the Fisheries Exploitation of Phytophagous Fishes in the USSR, Akad. Nauk Turkmensk SSR, Ashkhabad, pp 89-93.

Gopalakrishnan, V., "Diseases and Parasites of Fishes in Warm-Water Ponds in Asia and the Far East," 1968, FAO Fish. Rep. 44(5):319-343.

Gopinath, K., "Fresh Water Fish Farming in the Malay Archipelago," 1950, J. Zool. Soc. India 2(2):101-108.

Gorbach, E. I., "Age Composition, Growth and Age of Onset of Sexual Maturity of the White Ctenopharyngodon idella (Val.) and the Black Mylopharyngodon piceus (Rich.) Amurs in the Amur River Basin," 1961, Vopr. Ikhtiol. 1:119-126, translation.

\_\_\_\_\_, "Maturation and Breeding of the Grass Carp (Ctenopharyngodon idella in the Middle Course of the Amur River," 1965, Vopr. Ikhtiol. 5(3): 426-441.

\_\_\_\_\_, "Characteristics of Maturation and Propagation of Ctenopharyngodon idella (Val.) in the Amur Valley of the Soviet Union," 1966, Collected Articles of the 7th Plenary Conf. of the Comm. of the Fish. Res. of the West Pacific, Peiping, 176-180.

Gorbach, E. I., "Condition and Fatness of the Grass Carp Ctenopharyngodon idella (Val.) in the Amur Basin," 1971, J. Ichtyol. 11(6):880-890.

\_\_\_\_\_, "Fecundity of the Grass Carp (Ctenopharyngodon idella (Val.)) in the Amur Basin," 1972, J. Ichthyol. 12(4):616-624.

Gordan, L. M., "Methods of Pond Fishery Management Applied in the USSR," 1965, Paper presented to the Seminar on Fish Culture in the Inland Waters of the USSR for the FAO Fellowship Study Group, Leningrad, 30 pp.

Goreglad, P., "Diseases and Parasites of Fish," 1955, Nauka, Moscow (in Russian).

Goryunova, A. I., "On the Growth of Grass Carp (Ctenopharyngodon idella) in Alma-Ata Pond Fisheries," 1963, Akad. Nauk. Turkmensk. SSR, Ashkhabad, 176-177.

\_\_\_\_\_, "Experience of the Breeding of the Grass Carp in the Alma-Ata Pond Fish Farm," 1968, In: New Research on the Ecology and Propagation of Phytophagous Fishes, G. V. Nikolskii (ed.), Nauka, Moscow.

\_\_\_\_\_, "Variability in the Rate of Embryogeny of the Grass Carp (Ctenopharyngodon idella (Val.)), " 1971, J. Ichtiol. 11:44-48.

Goryunova, A. I., G. M. Agapova, M. D. Rozmanova, and M. Ya. Vetisheva, "Experience of the Rearing of Grass Carp Fingerlings," 1966, In: Phytophagous Fishes, N. G. Landa (ed.), Moscow (in Russian).

Greenfield, David W., "An Evaluation of the Advisability of the Release of the Grass Carp, Ctenopharyngodon idella, Into the Natural Waters of the United States," Trans. Ill. State Acad. Sci. 66(1/2): 47-53.

Grozavu, P., "Biologia Sumara a Speciilor de Pesti din Ihtifauna R. P. Chineza, Aflati in Curs de Aclimatizare in R. P. R. si Rezultatele Obtinute in Directia unor Astfel de Aclimatizari in Alte Tari in Conditii de Clima Asemanatoare cu a Tarii Noastre," 1962, Bul. Inst. Cercet, Pisc. 21(4):12-24.

Grozev, G., A. Bojadziev, and P. Nacev., "First Attempts to Propagate and Raise Herbivorous Fish in Bulgaria," 1971, Izv. Stancijata Sladkovadno Ribarstvo 7:89-98.

Gurova, L. A., "Feeding and Growth of Plant-Eating Fish in Ponds in the Chita State Regional Electric Power Plant," 1972, Zap. Zabaikal. Fil. Geogr. O-Va. SSSR 62:74-84 (in Russian).

Gurova, L. A., V. P. Gurov, E. L. Zubareva and N. M. Pronin, "First Experiment in Raising Fry of Plant-Eating Fish in Ponds of the Chita State Regional Electric Power Plant," 1972, Zap. Zabaikal. Fil. Geogr. O-Va. SSR 62: 59-73.

Gyldenholm, A. O. and J. J. Scheel, "Chromosome Numbers of Fishes," 1972, J. Fish. Biol. 3(4):429-486.

Herre, A. W., "Fishes from Kwangtung Province and Hainan Island, China," 1932, Lingnan Sci. J. 11:423-443.

Herre, A. W., "Notes on the Habitat of Some Chinese Fresh Water Fishes," 1934, Lingnan Sci. J. 13(2):327-328.

Hickling, C. F., "Fish Farming in the Middle and Far East," 1948, Nature, 161:748.

\_\_\_\_\_, "Observations on the Growth Rate of the Chinese Grass Carp, Ctenopharyngodon idellus (C. et. V.)," 1960, Malay. Agri. J. 43(1):49-53.

\_\_\_\_\_, "Fish Culture," 1962, Faber and Faber, London, 295 pp.

\_\_\_\_\_, "Biological Control of Aquatic Vegetation," 1965, Pest Articles and News Summaries, 11(3):237-244.

\_\_\_\_\_, "On the Feeding Process in the White Amur, Ctenopharyngodon idella," 1966, J. Zool. 148(4):408-419.

\_\_\_\_\_, "The Artificial Inducement of Spawning in the Grass Carp," 1966, Proc. Indo-Pacif. Fish. Coun. 12(2):236-243.

\_\_\_\_\_, "On the Biology of a Herbivorous Fish, the White Amur or Grass Carp, Ctenopharyngodon idella (Val.)," 1967, Proc. Roy. Soc. Edinburgh B, 70(1):62-81.

\_\_\_\_\_, "Fish-Hybridation," 1968, FAO Fisheries Rep. 44(4): 1-11.

\_\_\_\_\_, "The Farming of Fish," 1968, Pergamon Press, London, 88 pp.

\_\_\_\_\_, "Fish Culture," 1971, Faber and Faber, London, 317 pp.

Hoffman, W. E., "Preliminary Notes on the Fresh-Water Fish Industry of South China, Especially Kwangtung Province," 1934, Lingnan Sci. Bull. 5:

Hofstede, A. E., "Pond Culture of Warm-Water Fishes in Indonesia," 1951, In: Proceedings of the United Nations Scientific Conference on the Conservation and Utilization of Resources, New York, U. N. 7:136-138.

\_\_\_\_\_, "Improvement of Fish Production by Means of Introduction of New Fish Species," 1952, Bamidgeh 4(10-12):205-213.

Holcik, J., "Discovery of the Chinese Grass Carp - Ctenopharyngodon idella (Valenciennes, 1844) in the Morava River, Czechoslovakia," 1969, Vest. Csl. Zool. Spol. 33: 334-336.

Holm, L. G., L. W. Weldon and R. D. Blackburn, "Aquatic Weeds," 1969, Science 166: 699-709.

Hora, S. L. and T.V.R. Pillay, "Handbook on Fish Culture in the Indo-Pacific Region," 1962, FAO Fish. Biol. Tech. Pap. 14, 203 pp.



Hora, S. L. and T.V.R. Pillay, "The Cultivated Fishes of the Indo-Pacific Region," 1962, Indo-Pacif. Fish. Counc., Bangkok, 76 pp.

Huet, Marcel, "Textbook of Fish Culture: Breeding and Cultivation of Fish," 1970, Fishing News (Books) Ltd., London, Transl. from French by H. Kahn.

I-Kuei, Chiang, C. Chin-hsia and Ch'en Hsi-t'ao, "A Study on the Nutrition and Bait Materials of Ctenopharyngodon idella (Valenciennes)," 1966, Collected Articles of the 7th Plenary Conf. of the Committee of Fish. Res. of the West Pacific, pp 88-94.

Ilin, W. M. and L. M. Solovieva, "Production and Wintering of Yearling of Phytophagous Fish," 1965, Vopr. Prud. Ryb. 13:11-21 (in Russian).

Inaba, D., "Imported Species and its Propagation in Freshwater Pisciculture -- The Propagation of Imported Fishes from China at the River Tone and Ara," 1954, Rakusui 3 (in Japanese).

\_\_\_\_\_, "On the Propagation of Grass Carp in the River Tone," 1956, 28th Meeting Lakes, River and Pisciculture Cong. at Konagawa.

Inaba, D. and M. Normura, "On the Digestive System and Feeding Habits of Young Chinese Carp Collected in the River Tone," 1956, J. Tokyo Univ. of Fish, 42(1):17-25.

Inaba, D., M. Normura and M. Nakamura, "Preliminary Report on the Spawning of Grass-Carp and Silver-Carp in the Tone River, Japan and the Development of Their Eggs," 1957, J. Tokyo Univ. Fish. 43(1):81-101.

Indo-Pacific Fisheries Council, "News From Member Governments, Japan. Silver and Grass Carp Bred in Japan," 1957, Curr. Aff. Bull Indo-Pacific Counc. 20:21.

Indo-Pacific Fisheries Council, "News from Member Governments, United Kingdom, Hong Kong, Fish Culture Activities," 1958, Curr. Aff. Bull Indo-Pacif. Fish Counc. 21:20.

\_\_\_\_\_, "News from Member Governments, United Kingdom, North Borneo, Freshwater Pond Fish Culture," 1958, Curr. Aff. Bull Indo-Pacif. Fish. Counc. 21:20.

\_\_\_\_\_, "Carp Breeding," 1961, Curr. Aff. Bull Indo-Pacif. Fish. Counc. 32:18.

\_\_\_\_\_, "General Trends, Tropical Fish Culture," 1961, Curr. Aff. Bull Indo-Pacif. Fish. Counc. 30:32.

\_\_\_\_\_, "Fish Culture and Fish Disease Control," 1966, Proc. Indo-Pacif. Fish Counc. 12(1):42-43.

Indo-Pacific Fisheries Council, "Exotic Fish," 1967, Curr. Aff. Bull. Indo-Pacif. Council. 48:19.

Indrambarya, B., "Rice Field Fish Culture in the Lower Chiengrak-Klong Dan Irrigation Project Area," 1962, Indo-Pacif. Fish Council. CP 3, 15 pp.

Isaev, A. I., "Fish Breeding in the Chinese People's Republic," 1958, Rybovod. Rybolov. 1(2):50-52.

\_\_\_\_\_, "The Reproduction of Phytophagous Fish in the Northern Waters," 1968, In: New Research on the Ecology and Propagation of Phytophagous Fishes, G. V. Nikolskii (ed.), Nauka, Moscow.

Ivanova, I. M., V. S. Kirpichnikov, and N. N. Rolle., "Variability of Lactate Dehydrogenase (LDH) in Cultured and Wild Carp (Cyprinus carpio L.)," 1973, In: Biochemical Genetics of Fish, V. S. Kirpichnikov, A. S. Troshin, and I. I. Fridlyanskaya (eds.), pp 91-96, Institute of Cytology Akad. Nauk SSR, Leningrad.

Ivanova, N. S., "The Parasitic Ciliates (Urceolariidae, Peritricha) of Pond Fishes," Acta Protozol. 8(8-18):209-216.

Ivaskik, V. M., O. P. Kulakovskaya and N. I. Vorona, "Parasite Exchange Between Herbivorous Fish Species and Carp in Ponds in the Western Ukraine," 1969, Gidrobiol. Zh. 5(5): 100-103.

Jähnichen, H., "Experience with Plant Eating Fish in Poland," 1967, Dt. Fischerei-Ztg. 14(12): 367-374.

\_\_\_\_\_, "The Consumption of Aquatic and Terrestrial Plants by Young Grass Carp (Ctenopharyngodon idella)," 1967, Dt. Fischerei-Ztg. 14(5):147-151.

\_\_\_\_\_, "The Wintering of Young-of-the-Year Grass Carp (Ctenopharyngodon idella) 1966/67," 1967, Dt. Fischerei-Ztg. 14(5):147-151.

\_\_\_\_\_, "On the Artificial Reproduction of Phytophagous Fish," 1968, Dt. Fischerei-Ztg. 15(3): 57-66.

\_\_\_\_\_, "How Many Bones Do Grass Carp and Silver Carp Have?" 1971, Dt. Fischerei-Ztg. 18(2):41-43.

\_\_\_\_\_, "Investigations on the Rearing of Several-Years Old Grass Carp (Ctenopharyngodon idella) in Carp-Fry Growing Ponds," 1971. Dt. Fischerei-Ztg. 18(2):33-35.

\_\_\_\_\_, "Marketing Grass Carp," 1971, Dt. Fischerei-Ztg. 18(2):43-49.

\_\_\_\_\_, "Organ Masses and Chemical Composition of the Flesh of the Grass Carp (Ctenopharyngodon idella) and Silver Carp (Hypophthalmichthys molitrix)," 1971, Dt. Fischerei-Ztg. 18(2):35-40.

Jähnichen, H., "Test Sale With Grass Carp (Ctenopharyngodon idella)," 1971, Dt. Fischerei-Ztg. 18(2):43-49.

\_\_\_\_\_, (ed.), "Biological Weed Control," 1973, Herausgegeben vom. Institut für Binnenfischerei, Berlin-Friedrichshagen, 44 pp.

\_\_\_\_\_, "Further Success in the Introduction of Grass Carp (Ctenopharyngodon idella) for the Biological Control of Aquatic Weeds in Waterways," 1973, Z. Binnenfischerei 20(8): 227-228.

\_\_\_\_\_, "The Efficacy of Amur Carp (Ctenopharyngodon idella) in Biological Control of Aquatic Vegetation in the Waters of the German Democratic Republic," 1973, Z. Binnenfischerei DDR 20:14-28.

\_\_\_\_\_, "6 Million Individuals of Amur Carp! Experience With the Artificial Reproduction of Amur Carp (Ctenopharyngodon idella) in the DDR," 1973, Z. Binnenfischerei DDR 20(7): 213-223.

Jähnichen, H. and S. Fritsche, "Contribution to the Behavior of Phytophagous Cyprinids Especially of Amur Carp (Ctenopharyngodon idella) With their Significance for Waters of the German Democratic Republic," 1972, Z. Binnenfischerei 19(5): 139-146.

Jähnichen, H. and A. Kozianowski, "Experience with Plant-Eating Fish in the People's Republic of Poland," 1967, Stsch. Fischerei-Ztg. 14(12):367-374.

Januszko, M., "Algae at the Ponds Stocked with Larvae of Carp and Phytophagous Fish," 1972, Roczn. Nauk Roln. Ser. B. Zootec.

Japan Fisheries Agency, "Inland Water Fisheries and Aquaculture in Japan," 1952, Tokyo.

Jashew, L. and A. Bojadschew, "Chraniteina Stoinost I Rokusowi Katschestwa na Belija Amur," 1969, Ribno stopanstwo 16(6):22-24.

Jeffrey, N. B., "Spawning the Grass Carp (Ctenopharyngodon idella)," 1970, FAO Fish. Cult. Bull. 2(2):3.

Job, T. J., "Fish Seed Industry in India," 1952, Proc. Indo-Pac. Fish. Council. 2 and 3:202-208.

Karpevich, A. F., "Salinity Requirements of Grass and Silver Carp Transplanted to Brackish Waters," 1966, Ref. Zh. Biol. No. 10196.

Kawamoto, N. Y., "The Influence of Sex Hormones on the Reproductive Organs of a Sogyo Ctenopharyngodon idella (C. and V.)," 1950, Jap. J. Ichthyol. 1(1):8-16.

Keiz, G., "Stocking of a New Agent for the Effective Control of Undesirable Pond Plants," 1964, Allg. Fischerei-Ztg. 89(1):13-16.

Kharitonova, N. N., "White Amur-Supplementary Fish in Carp Ponds," 1967, Rybn. Khoz. 43:33-37.

Kharitonova, N. N., E. A. Blyskavka, and O. M. Tarasova, "The Nutrition and Growth of Two-Year-Old-Carp and White Amur Grown Together," 1968, Ryb. Khoz. Respub. Mezhvedom. Temat. Nauch. Sb. (6): 112-116.

Kharitonova, N. N. and O. M. Tarasova, "Combined Rearing of Common and Grass Carps in the Ukraine," 1968, G. V. Nikolskii (ed.), In: New Research on the Ecology and Propagation of Plant-Eating Fish, pp 89-93.

Khyng, D. Ti., "Food Requirements of Grass Carp Fingerlings Reared in Polycultures (With Common and Silver Carp and Bighead)," 1970, Dokl. Timiryazev S-Kh. Akad. 164:337-341.

Kilgren, R. H. and R. O. Smitherman, "Food Habits of the White Amur Stocked in Ponds Alone and in Combination with Other Species," 1971, Prog. Fish-Cult. 33(3):123-127.

Kim, I.-B., "Propagation of Grass Carp and Silver Carp," 1970, Bull. Pusan Fish. Coll. 10(1): 33-49.

Kirpichnikov, V. S., Pond Fish Selection Paper Presented to Seminar on Fish Culture in the Inland Waters of the USSR for the FAO Fellowship Study Group, 1965, Leningrad, 19 pp (Mimeo).

Kobayashi, S. and S. Mizumoto, "Studies on the Hybrid of Ctenopharyngodon idellus (Cuvier and Valenciennes) and Cyprinus carpio. (2) On the Morphological Characteristics of the Hybrid," 1950, Sci. Rep. Shiga Fish. Station (1):10-13.

Koleiheichin, M. L., "Biological Basis for the Rational Conduct of Fresh Water Fisheries in the Amur Valley," 1966, Collected Articles of the 7th Plenary Conf. of the Committee of Fish. Res. of the West Pacific, Peiping, pp 181-186.

Komarova, I. V., "Pond Zooplankton in Polyculture of Fishes," 1969, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 16: 141-150.

Konradt, A. G., "Prerequisites for the Breeding of Phytophagous Fishes in the Pond Fish Farms of the Soviet Union," 1961, Nauchntekn. Biull. Vses. Nauchno-issled. Inst. Ozer i Rechn. Rybn. Khoz. (13-14):53-57.

\_\_\_\_\_, "Experimental Cultivation of Grass Carp in Ponds of the Leningrad Region," 1962, Nauchn-Tekh. Byul. Gas. Nauchn-Issled. Inst. Ozer. Rech. Ryb. Khoz. 15:55-57.



Konradt, A. G., "Methods of Breeding the Grass Carp, Ctenopharyngodon idella, and the Silver Carp, Hypophthalmichthys molitrix," 1965, FAO Fish. Rept. 44(4): 195-203.

\_\_\_\_\_, "Analysis of the Application of Fractional Pituitary Injection and Methods of Maintaining and Transportation of Larvae of Plant-Eating Fishes," 1969, Izv. Gosud. Nauchno-issled. Inst. Ozer. Rechn. Rybn. Khoz. 65:165-180.

Konradt, A. G. and K. A. Faktorovich, "Hydropsy of the Grass Carp," 1963, Tez. Dokl. Vses. Soveshch. Belezn. Ryb. 4:55.

\_\_\_\_\_, "A Case of Dropsy in Grass Carp," 1966, In: Selective Breeding of Carp and Intensification of Fish Breeding in Ponds, V. S. Kirpichnikov (ed.) Izv. Gosud. Nauch-issled. Inst. Ozer. Rechn. Rybn. Khoz. 61: 216-233 (transl. by Technical Information Service, Springfield, Va.).

Konradt, A. G. and V. K. Vinogradov, "On the Possibility of Sexual Maturation and Reproduction of the Grass and Silver Carps in River and Lake Systems of the U.S.S.R.," 1961, Thezisy Soveshch. Rybn. Khoz. vnutr Vodoem. 2:62-63.

Konstantinova, N. A., "Some Data on Age and Growth of the Amur Bream Leuciscus waleckii (Dyb.) and the White Amur Ctenopharyngodon idella Val. Trud. Amursk. Ikhtiol. Expedition 1945-1949, Vol IV.

Kornienko, G. S., "Development of Phytoplankton on Rice Fields and Nutrition of Silver Carp," 1971, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 18: 105-113.

\_\_\_\_\_, "The Role of Infusoria in the Food of the Larvae of Phytophagous Fishes," 1971, J. Ichthyol. 11(2): 241-246.

Korshunova, L. A., "Comparative Morphology of Excretory Ducts of Alimentary Canal Glands in Some Phytophagous and Predator Fish," 1971, Acad. Nauk Ukrainian SSR, Vestn. Zool. 4(5): 76-78.

\_\_\_\_\_, "Comparative Morphology of Excretory Ducts of Alimentary Canal Glands in Some Phytophagous and Predator Fish," 1971, Vestn. Zool. 5(5):74-76.

\_\_\_\_\_, "Comparative Histology of the Alimentary Canal of Some Teleost Fish in Connection with Different Characters of Nutrition," 1972, Dopov. Akad. Nauk. Ukr. Rsr. Ser. B. Heol Heofiz Khim. Biol. 34(8):750-752.

\_\_\_\_\_, "Relation Between Differentiation of Some Elements in Connective Tissue and Growth of Alimentary Canal in Fish," 1972, Dopov. Akad. Nauk. UKR 34(1):72-74.

Krüger, A., "Studies on Labelling Carp and Herbivorous Fish With Radio-active Phosphorous," 1969, 3<sup>2</sup>P. Roczn. Nauk Roln. (Ser. H.) 91(4):512-523 (in Polish).

Krupauer, V., "Transfer of Herbivorous Fish from the USSR," 1965, Bul. Vyzk. Ust. Ryb. Vodnany 1(3):28-31.

\_\_\_\_\_, "Acclimatization of Herbivorous Fish," 1966 (Review), Sb. Csl. Akad. Zemed. Ved. (E). (5-6):1-108 (in Czech).

\_\_\_\_\_, "Acclimatization of Herbivorous Fish," 1966, Studijni Inf. Zivoc. Vyroba 5/6, 103 pp.

\_\_\_\_\_, "Food Selection in 2-Year-Old Grass Carp," 1967, Bul. vyzk. Ust. ryb., Vodnany 3:7-17.

\_\_\_\_\_, "Acclimation of Herbivorous Fish in Europe," 1968, Souhrn Referatu z Ved. Seminare Vyuziti Nekteryh v. Chovu ryb, UVTI-VZPV, Prague, 62: 87-124 (in Czech).

\_\_\_\_\_, "Experience Gained in the Rearing of Herbivorous Fish in Czechoslovakia," 1968, Bul. Vyzk. Ust. Ryb. Vodnany 4(2):3-15.

\_\_\_\_\_, "The Plant Consumption Capacity of 3- and 4-Year-Old Grass Carp," 1968, Zivocisna Vyroba 13(7):467-74 (Czech, English summary).

\_\_\_\_\_, "The Use of Herbivorous Fishes for Ameliorative Purposes in Central and Eastern Europe," 1971, Proc. Eur. Weed. Res. Council 3rd Int. Symp. Aquatic Weeds, pp 95-103.

Krupauer, V., and F. Kubu, "The Possibilities of an Acclimatization of Herbivorous Fish in Czechoslovakia," 1965, Cslky Rybar 20(9):136-137.

Kryzhanovskii, S. G., "Ecological Groups of Fishes and Regularities of Their Development," 1948, Izvestiya TINRO 27:3-114.

\_\_\_\_\_, "Ecological-Morphological Aspects of Natural Development and Cyprinidae, Cobitidae and Siluroidea Fishes," 1949, Trudy Inst. morfol. Zhivot. Acad. Nauk. SSSR 1:5-332.

Kryzhanovsky, S. G., A. I. Smirnov and S. G. Soin, "Data on Herbivorous Fish of the Amur River. Studies of the Amur Ichtiological Expedition 1945-1949," 1951, Mat. Pozn. Fauny Flory SSSR (Zool.) 24:5-222.

Kubu, F. and V. Krupauer, "Information on the Rearing of Grass Carp," 1965, Cslky Rybar 12(4):180.

Kulakova, A. M., "Experimental Transfer of Grass Carp (Ctenopharyngodon idella) and Silver Carp (Hypophthalmichthys molitrix) for Acclimatization Purposes," 1963, In: Problems of the Fisheries Exploitation of

Phytophagous Fishes in the Waters of the U.S.S.R., Akademiya Nauk Turkmenk SSR, pp 70-75.

Kumanski, K. R., "Contributions to Histophysiological Ovulation in Ctenopharyngodon idellus (Val.) Following Stimulation with Hypophysical Extract," 1968, Bulg. Akad. Nauk Izv. Zool Inst. Mus. 27:41-49 (Russian with English summary).

Kuronuma, K., "Do Chinese Carps Spawn in Japanese Waters?" 1954, Indo-Pac. Fish. Coun. Proc. II 5:126-130.

\_\_\_\_\_, "Spawn Taking of Chinese Carp in the Tone River, Japan," 1958, Indo-Pac. Fish. Coun. Curr. Affairs Bull. No. 22, 3 pp.

\_\_\_\_\_, "New Systems and New Fishes for Culture in the Far East," 1968, FAO Fish. Rep. 44(5):123-142.

Kuronuma, K. and K. Nakamura, "Fish Culture in Farm Pond and Experiment by Stocking Grass Carp," 1957, Proc. Indo-Pacif Fish Coun. 7(11): 35-42.

Kuznetsoya, I. I. and V. S. Matiushin, "The First Year of Operation of the Tsimlyansk Fish Hatchery," 1961, Rybn. Khoz. 37(6):27-30.

Kyrylenko, N. S. and I. E. Skrodsko, "Age-Related Characteristics in Lipid Fractions of Tissues and Blood in Fishes of the Amur Basin," 1974, Ukr. Biokhim. Zh. 46(6): 745-748.

Lachner, E. A., C. R. Robins, and W. R. Courtenay, "Exotic Fishes and Other Aquatic Organisms Introduced in N. America," 1970, Smithsonian Contr. Zool. 59: pp 29.

Lakshmanan, M. A. V., K. K. Sukumaran, D. S. Murty, D. P. Chakraborty and M. T. Philipose, "Preliminary Observations on Intensive Fish Farming in Fresh Water Ponds by the Composite Culture of Indian and Exotic Species," 1971, J. Inland Fish. Soc. India 3:1-21.

Lavrovsky, V. V., "Raising of Rainbow Trout (Salmo gairdneri Rich.) Together with Carp (Cyprinus carpio L.) and Other Fishes," 1968, FAO Fish. Rep. 44(5):213-217.

Lawrence, J. M., "Aquatic Weed Control in Fish Ponds," 1968, FAO Fish. Rep. 44(5):76-91.

Lebedeva, I. M., "Economic Effect of Herbivorous Fish in Fish Farms of Krassnodar District," 1971, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 18: 114-121.

LeMare, D. W., "'Weeding' in Fish Farming," 1948, Nature 162(4122):704.

Leonenko, E. P., "Hemoglobin Level as an Index of Fish Viability and Productivity (With Special Reference to Carp, Grass Carp and Silver Carp)," 1966, In: Report Summaries of the All-Union Conference on the Ecology and Physiology of Fishes, Moscow, pp 100-101.

Leonenko, E. P. and V. P. Lyakhnovich, "Comparative Morpho-Physiological Peculiarities of White Amur, Silver Carp and Carp Reared in Belorussian Ponds," 1968, In: Ecological Physiological Peculiarities of the Blood of Fish. Akad. Nauk SSSR. Moscow, pp 28-42.

Leonte, E., "Comparative Study of the Energy Metabolism in the Species Ctenopharyngodon idella and Hypophthalmichthys molitrix Embryos and Larvae," 1969, Bul. Inst. Cercet Piscic. 28(4): 33-40.

\_\_\_\_\_, "Quantitative Variations in Pineal Organ Nuclei Diameters in the Teleost Fish Ctenopharyngodon idella (Val.) 1 and 3 Years Old, During the Periods of Maximum Growth and of Slowing and Ceasing," 1972, Bul. Inst. Cercet Pisc. 31(3/4)77-84 (in Romanian).

Letichevskii, M. A., "Artificial Propagation of the Grass Carp in the Volga Delta," 1967, Trud. Kasp. Nauchno-issled. Inst. Rybn. Khoz. 33:145-180.

Liao, H. H. and L. C. Shih, "Contribution to the Biology and Control of Bothriocephalus gowkongensis Jeh; a Tape Worm Parasite in the Young Grass Carp Ctenopharyngodon idella (C. and V.)," 1956, Acta Hydrobiol. Sin. 2.

Liepolt, R. and E. Weber, "Studies with Phytophagous Fish (Ctenopharyngodon idella)," 1969, Revue Rommaine de Biologie, Series de Zoologie, 14(2):127-132.

Lin, S. Y., "The Fish Fry Industry of the West River," 1933, Bull. Canton. Bur. Agric. Fish. 9.

\_\_\_\_\_, "Life History of Waan ue, Ctenopharyngodon idellus (Cuv. and Val.)," 1935, Lignan Sci. J. 14(1):129-135 and 14(2):271-274.

\_\_\_\_\_, "Fish Culture in Ponds in the New Territories of Hong Kong," 1946, J. Hong Kong Fish. Res. Sta. 1(2):161-193.

\_\_\_\_\_, "Fish Culture in the New Territories of Hong Kong," 1949, Indo-Pacific Fish. Council. 7(11):35-42.

\_\_\_\_\_, "Notes on Fish Fry Industry of China," 1949, Proc. Indo-Pac. Fish Council. 1:65-71.

\_\_\_\_\_, "Pond Culture of Warm Water Fishes," 1951, Proc. U.N. Sci. Conf. Cons. Utiliz. Res. 7:131-135.



Lin, S. Y., "Chinese Systems of Pond Stocking," 1954, Tech. Pap. Indo-Pacif. Fish. Councl 1:113-125.

\_\_\_\_\_, "Induced Spawning of Chinese Carp by Pituitary Injections in Taiwan," 1965, Chin.-Am. Joint Comm. Rural Reconstr. Fish. Ser. 5, 31 pp.

\_\_\_\_\_, "Pond Fish Culture and the Economy of Inorganic Fertilizer Application," 1968, Chin.-Am. Joint Comm. Rural Reconstr. Fish. Ser. 6, 27 pp.

Linchevskaya, M. P., "The Diet of Grass Carp Fry," 1966, Dokl. Akad. Nauk SSSR 166:729-731.

\_\_\_\_\_, "The Role of Phytoplankton in the Diet of Grass Carp During Early Stages of its Development," 1967, In: Biological Losses of the Fishing Industry in Central Asian and Kazakhstan Waters, Ref. Zh. Biol. 4184. Biol. Abstr. 1968, No. 114647.

Ling, S. W., "Control of Aquatic Vegetation," 1960, In: Lectures, 3rd Internat. Inland Fish. Training Center, FAO, Rome, 12 pp.

\_\_\_\_\_, "Pond Culture in Asia Except Indoesia," 1960, In: Lectures, 3rd Internat. Inland Fish. Training Center, FAO, Rome, 29 pp.

\_\_\_\_\_, "Feeds and Feeding of Warm-Water Fishes in Ponds in Asia and the Far East," 1966, FAO World Symp. on Warm Water Fish Cult, FAO III-VIII, 19 pp.

\_\_\_\_\_, "Fish-Cum-Duck Farming in Taiwan," 1971, FAO Aquaculture Bull. 4 (No. 1):8.

Liu, C. K., "On the Productivity of Two Experimental Fish Ponds Managed With Traditional Methods of Chinese Pisciculture," 1955, Acta Hydrobiol. Sin. 1:25-43.

\_\_\_\_\_, "Experiment on the Artificial Propagation of the Grass Carp, Ctenopharyngodon idellus, Cultured in Ponds," 1963, Chung-kuo Shuetsang 129:2-4 (in Chinese).

\_\_\_\_\_, "Experiments on the Artificial Spawning of Farming Fishes, Grass Carp and Silver Carp," 1964, Bull. Taiwan Fish. Res. Inst. 9:59-70 (in Chinese).

Liu, C. K. and T. T. Su, "Pliocene Fishes from Yushe Basin, Shansi," 1962, Vertebr. palasiat. 6(1):1-47 (in Chinese, English summary).

Lubyanskene, V. N., K. K. Yankyavichyus and Ya. S. Shivokene, "Role of Digestive Tract Microorganisms in the Nourishment of the Pond Fish: 3. Microbiological Investigations of the Intestine," 1973, Liet. Tsr. Moksiu Akad. Doubai Ser. C. 2:105-110 (in Russian).

Lukanin, A. P., "An Experiment in Rearing the White Amur in Ponds of the Angelinsk Fish Rearing Station," 1959, Rybn. Khoz. 35(6): 82-83.

Lupacheva, L. I., "Some Observations of Ecology and Feeding of Summer-Old White Amur in Ponds in the South Ukraine," 1967, Rybn. Khoz. 43(4):65-67.

\_\_\_\_\_, "The Food of the Grass Carp in the Early Stages of Its Development," 1967, Rybn. Khoz. 43(6): 82-83.

\_\_\_\_\_, "Higher Aquatic Vegetation in Ponds of the Tsyrypinsk Spawning-Breeding Farm," 1968, Rybn. Khoz. Respub. Mezhved. Temat. Nauch. Sb. 6, 98-101.

Lupacheva, L. I. and R. A. Baltadzki, "A Study of the Higher Aquatic Vegetation of the Coolant-Reservoir of the Mironvskaya GRES (Thermal Power Station) in Relation to Stocking with Herbivorous Fish," 1971, Rybn. Khoz. 47(12): 75-78.

Lyakhnovich, V. P., "Increasing the Fish Productivity of Ponds in Belorussia," 1966, In: Selective Breeding of Carp and Intensification of Fish Breeding in Ponds, V. S. Kirpichnikov (ed.), pp 224-234.

Lyakhnovich, V. P. and E. N. Leonenko, "Age-Related Changes in Some Characteristics of the Blood of the Silver Carp (Hypophthalmichthys molitrix (Val.)), the Grass Carp (Ctenopharyngodon idella (Val.)), and the Pond Carp (Cyprinus carpio (L.)), " 1971, J. Ichthyol. 11(5):743-750.

Lyasauskene, L. B., K. K. Yankyavichyus and Ya. S. Shivokene, "Role of Microorganisms of the Gastrointestinal Tract in the Nutrition of Pond Fish. Amount of Free Amino Acids in Some Species of Second Year Fish and the Ability of Microorganisms to Synthesize Them," 1974, Liet. Tsr. Mokslu, Akad. Darb. Ser. C. Biol. Mokslai 2: 127-136.

Magomaev, F. M., "The Effect of Grass Carp on Plant Associations and Their Dynamics in Overgrown Reservoirs of Dagestan," 1973, Trud. Vses. Nauch.-issled. Inst. Prud. Rybn. Khoz. (21): 16-21.

Makeeva, A. P., "Conference on the Acclimatization of Amur Fish in the Reservoirs of the European Part of the USSR, Kiev, 3-4 February 1958," 1959, Zool. Zh. 38(1): 149-151.

\_\_\_\_\_, "On Maturation of Females of the Grass and Silver Carp and Propagation of These Species in the Basin of the Amur," 1963, In: Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR, Akad. Nauk. Turkmansh SSR, Ashkabad, pp 203-209.

Makeeva, A. P., "The Maturity and Propagation of Economic Pisces Laying Floating Eggs in the Amur River," 1966, Collected Articles of the 7th Plenary Conf. of the Comm. of Fish. Research of the West Pacific, Peiping, pp 164-170.

\_\_\_\_\_, "Hybridization of Wild Carp with Phytophagous Fish," 1968, Probl. Ithtiol. 8(2):371-374.

Makeeva, A. P. and R. E. Muravleva, "Survival Rate of Larvae of the Grass Carp (Ctenopharyngodon idella) During Starvation," 1969, Biol. Nauk 12(2): 17-21.

Makeeva, A. P. and A. I. Sukhanova, "Development of Hybrids of Phytophagous Fishes," 1966, Vopr. Ichtiol. 6(3):477-497.

Makeeva, A. P. and B. V. Verigin, "Use of the Method of Pituitary Injections in the Propagation of Silver Carp and Grass Carp," 1971, J. Ichthyol. 11(2):174-185.

Malacca, Tropical Fish Culture Research Institute, 1957-1967, Annual Reports Trop. Fish. Cult. Res. Inst.

Mann, H., "Investigations on Feed Utilization in Grass Fish (Ctenopharyngodon idella)," 1968, Allgem. Fischerei-Ztg. 93(5):136.

\_\_\_\_\_, "Organgewichte und Fettgehalt beim Chinesischen Graskarp (Ctenopharyngodon idella)," 1968, Allgem. Fischerei-Ztg. 93(5):136.

Mantelman, I. I., "On the Possibility of Polyspermy in Teleostei," 1969, Dokl. Akad. Nauk SSSR. Biol. Sci. Sect. 189:820-823.

\_\_\_\_\_, "Cytological Study of Fertilization in Hybridization of Some Cyprinid Fishes," 1971, Tsitologiya 13(7): 837-843 (in Russian), Biol. Abstr 53:34235.

Marking, Leif L., "Sensitivity of the White Amur to Fish Toxicants," 1972, Prog. Fish-Cult. 34(1):26.

Martino, K. V., "The Acclimatization and Naturalization of Grass Carp in the Water Bodies of the Volga Delta," 1972, Tr. Vses. Nauchno-Issled. Inst. Morsk. Rybn. Khoz. Okeanogr. 89:38-41. Trans. from Russian by Fish. Res. Bd. Can. Transl. Ser. No. 3115, 1974.

\_\_\_\_\_, "Natural Reproduction of Ctenopharyngodon idella (Valenciennes) in the Lower Volga Water Bodies," 1974, Hydrobiol. J. 10(1): 81-83.

Mattheis, Th., "Vorläufige Ergebnisse Parasitologischer und Pathologischer Untersuchungen an Einsömmrigen Graskarpfen (Ctenopharyngodon idella)," 1967, Dt. Fischerei-Ztg. 14:151-157.

- Mattheis, T. and K. Odening, "Die Metacerie von Apharyngostrigea cornu bei Graskavpten (Ctenopharyngodon idella) in der Deutschen," 1969, Demokratischen Republik. Z. Fischerei 17:481-496.
- Mehta, I., R. Krishna and A. P. Taunk, "The Aquatic Weed Problem in the Chambal Irrigated Area and Its Control Using Grass Carp Fish," 1973, In: Abstracts, Regional Seminar on Noxious Aquatic Vegetation in Tropics and Subtropics, New Delhi, pp 48-49.
- Menzel, A. von, "Clearing Water with Herbivorous Fish," 1974, In: Proc. 4th Eur. Weed Res. Counc. Internat. Symp. on Aquatic Weeds, Vienna, pp 139-141.
- Meske, Ch., "Feeding of Grass Carp in an Aquarium with Protein-Rich Dry Feed," 1968, Fishwirt 18(12):310-315.
- \_\_\_\_\_, "Methoden der Künstlichen Laichgewinnung beim Grassfisch (Ctenopharyngodon idella)," 1974, Der Fischwirt Zt. schr. f.d. Binnenfisch 24(3):
- Mestrov, M., L. Ilijanic, V. Tavcar and J. Koprek, "The Influence of Grass-Carp Population (Ctenopharyngodon idella Val.) on the Vegetation and Ecosystem of Lake Trakoscan," 1973, Acta Bot. Croat. 32: 125-134.
- Mestrov, M. and V. Tavcar, "Problems of the Recovery of Trakoscan Lake and Application of Grass Carp (Ctenopharyngodon idella Val.)," 1973, Bull. Sci. Conseils Acad. Sci. Arts 18: 80-81.
- Miazin, I. D., "Economic Efficacy of Rearing Phytophagous Fish in the Volga Delta," 1967, Rybn. Khoz. 43(9):80-82.
- Michewicz, Jane E., D. L. Sutton, and R. D. Blackburn, "The White Amur for Aquatic Weed Control," 1972, 20(1):106-110.
- \_\_\_\_\_, "Water Quality of Small Enclosures Stocked With White Amur," 1972, Hyacinth Control J. 10: 22-25.
- Migala, K., "An Occurrence of the Protozoans of the Genus Cryptobia (Trypanoplasma) in the Blood of Ctenopharyngodon idella Val. Bred in Carp Farm Ponds," 1967, Wiad. Parazytol. 13: 275-278.
- \_\_\_\_\_, "Observations on the Infection by Protozoa from the Genus Cryptobia (Trypanoplasma) in the Blood-Vascular System of Grass Carp (Ctenopharyngodon idella Val.) Bred in Carp Ponds," 1971, Roczn. Nauk. Roln Ser. H. 93(3): 65-73.
- Migita, M. and Y. Hashimoto, "On the Digestion of Higher Carbohydrates by Zsuau-hi (Ctenopharyngodon idellus Cuvier & Valenciennes)," 1949, Bull. Jap. Soc. Sci. Fish. 15(6).



Mints, A. G. and E. N. Khairulina, "Intensive Forms of Rearing Fish in Ponds in Peat-Hags," 1968, FAO Fish. Rep. 44(5):233-242.

Mirica, G., "Din Realizarite Statiuni Pisciola 'Nikva' Baza de Cercetari Experimentale a Institutului de Cercetari Piscicole Pentru Apele Interioare ale RSS Ucraineene," 1962, Bul. Inst. Cercet. Pisc. 21(2): 18-30.

\_\_\_\_\_, "Primary Nurseries for the Reproduction in the Danube Delta of a Herbivorous Fish from China," 1965, Bul. Inst. Cercet. Pisc. 24(3/4):15-28.

\_\_\_\_\_, "Results of an Experiment with a Herbivorous Fish Recently Acclimated in the Danube Delta," 1968, Bul. Inst. Cercet. Pisc. 27(1):45-49 (in Rumanian).

Mirica, G., A. Nicolau, E. Popescu and I. Radulescu, "Results of Research Concerning the Introduction into Rumanian Waters of Some Fish Species Originating in China," 1966, Bul. Inst. Cercet. Proiect Piscic. 25(4): 5-30.

Mitchell, D. S. (ed.), "Aquatic Vegetation and Its Use and Control," 1974, UNESCO Paris, France 135 pp.

Mitzner, L., "Evaluation of Biological Control of Nuisance Aquatic Vegetation by White Amur: Behavioral Activity Patterns of White Amur," 1975, Federal Aid to Fish Restoration Annual Performance Report, Iowa Conservation Commission, pp 57-68.

Molnar, G., "On the Hematology of East Asian Herbivorous Carps: Spotted Silver Carp, Hypophthalmichthys nobilis Richardson, White Silver Carp, Hypophthalmichthys molitrix Val. and Grass Carp, Ctenopharyngodon idella Val.," 1969, Arch. Fischereiwiss 20(1): 98-105.

Molnar, K., "Studies on Gill Parasitosis of the Grass Carp Ctenopharyngodon idella caused by Dactylogyrus lamellatus Achmerow, 1952: I. Morphology and Biology of Dactylogyrus lamellatus," 1971, Acta Vet. Acad. Sci. Hung. 21 (2/3):267-289.

\_\_\_\_\_, "Studies on Gill Parasites of the Grass Carp (Ctenopharyngodon idella) caused by Dactylogyrus lamellatus Achmerow, 1952: II. Epizootiology," 1971, Acta Vet. Acad., Sci. Hung. 21(4): 361-375.

\_\_\_\_\_, "Studies on Gill Parasitosis of the Grass Carp (Ctenopharyngodon idella) caused by Dactylogyrus lamellatus Achmerow, 1952: III. Therapy and Control," 1971, Acta Vet. Acad. Sci. Hung. 21(4):377-382.

\_\_\_\_\_, "Studies on Gill Parasitosis of the Grass Carp (Ctenopharyngodon idella) caused by Dactylogyrus lamellatus Achmerov, 1952: IV. Histopathological Changes," 1972, Acta. Vet. Acad. Sci. Hung. 24(1/2):63-71.

Molnar, K., "Protozoan Diseases of the Fry of Herbivorous Fishes," 1971, Acta Vet. Acad. Sci. Hung. 21(1):1-14.

\_\_\_\_\_, "On Diplostomosis of the Grass Carp Fry," 1974, Acta Vet. Acad. Sci. Hung. 24(1/2): 63-71.

Morawa, F., "Phytophagous Fishes in Eurasia," 1963, Fischwirt 13(12): 346-350.

Motenzov, J., "Reproduction of the Silver Carp in the Kuban," 1966, Rybovod. Rybolov. 1:16-17.

Motenzov, Y. M., "The Results of Settling Phytophagic Fish in Natural Waters in Krasnodar Krai," 1969, S.B. Nauchno-Tekh. Inf. Krasnodar Fil. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 1:59-61. Transl. Ref. Zh. Biol. No. 31207, 1970.

Movchan, V. A. and V. A. Prihodko, "Acclimatization of the White Amur and Tolstolobik in Ukrainian Ponds," 1956, In: Soveshchanie po Biologicheskim Osnovam Rybnogo Khozyaistva, Tezisy Dokladov, Tomsk, pp 80-82.

Mukhamedova, A. F., "Observations of Young Bighead Carp and Grass Carp During the Quarantine and the Rearing Period Before Release in Tsimlyansk Reservoir," 1963, In: Problems of Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR, Akad. Nauk Turkmen. SSR, Ashkhabad, pp 84-88.

Muravleva, R. E., "Feeding of Ctenopharyngodon idella (Val.) in the Early Stages of Development," 1968, Izv. Akad. Nauk. Turkmen. SSR (biol.) 1968(3):67-75.

\_\_\_\_\_, "Controlled Formation of a Food Base in Grass Carp Fish Hatcheries in the Turkmen SSR," 1974, Izv. Akad. Nauk Turkmen. SSR (5): 46-52.

\_\_\_\_\_, "Daily Rhythm and Daily Ration of White Amur (Ctenopharyngodon idella (Val.) Larvae in Turkmenian Ponds," 1974, Izv. Akad. Nauk. Turkmen. SSR (2): 46-52.

Murin, V. A., "Results and Prospects of Scientific Investigations on the Commercial Introductions of Herbivorous Fish," 1966, In: Fisheries Exploitation of Phytophagous Fishes, G. V. Nikolskii (ed.), Nauka, Moscow, pp 29-36.

Musselius, V. A., "Grass Carp Bothricephalosis and Its Treatment in Carp Farms," 1963, In: Problems of Fisheries Exploitation of Phytophagous Fish in Waters of the USSR, Akad. Nauk. Turkmen. SSR, pp 154-160.

\_\_\_\_\_, "On Parasite Fauna of Phytophagous Fishes Acclimated in USSR," 1965, Trudy vseross. Nauchno-issled. Inst. Rybn. Khoz. 13:55-56.

Musselius, V. A., "Main Trends in the Research on the Control of Helminthosis Occurring in Pond Fish," 1966, Izv. Akad. Nauk SSR Ser. Biol. (6): 883-887.

\_\_\_\_\_, "Biology and Specificity of Sinergasilus lienii Yin, 1949 (Crustacea, Copepoda)," 1967, Parazitologiya 1(2): 158-160.

\_\_\_\_\_, "Parasitosis of Phytophagous Fishes from the Far East Complex Cultured in Ponds of the European Part of the USSR," 1969, Parazitologiya 3(3): 236-243.

Musselius, V. A. and J. A. Strelkov, "Diseases of Phytophagous Fishes and Their Treatment," 1966, In: Fisheries Exploitation of Phytophagous Fishes, C. V. Nikolskii (ed.), Nauka, Moscow, pp 95-104.

\_\_\_\_\_, "Parasites and Diseases of the Grass and Silver Carps in Fish Farms of the USSR," 1968, In: Pillay T.V.R. (ed.) Proceedings of the FAO World Symposium on Warm-Water Pond Fish Culture. Fish. Rep. FAO No. 44(5):1966:353-360.

Nagayama, F. and Y. Saito, "Distribution of Amylase, Alpha- and Beta-Glucosidase, and Beta-Galactosidase in Fish," 1968, Bull. Jap. Soc. Sci. Fish. 34(10):944-947.

Naik, I. U., "Introducing Grass Carp (Ctenopharyngodon idella Cuvier and Valenciennes) in Pakistan," 1972, Pakistan J. Sci. 24:45-52.

Nakamura, K., "On the Relation Between the Increase of the Fishes and Water Plants in the Pool," 1950, Bull. Jap. Soc. Scient. Fish. 16(4):127-131 (Japanese, English summary).

Nakamura, K., M. Shimadate, H. Koyama, and H. Okubo, "Fish Production in Seven Farm Ponds in Shioda Plain, Nagano Prefecture with Reference to Natural Limnological Environment and Artificial Treatment," 1954, Bull. Freshwater Fish. Res. Lab., Tokyo 3(1):27-79.

Natali, V. F. and A. I. Natadi, "Development and Differentiation of the Gonads in Carps in Connection with the Problem of Transformation of Sexes," 1947, Uchenye Zapiski 40(3).

Nemeth, S., "The Breeding of Phytophagous Fishes," 1966, Halaszat 12:66-67.

\_\_\_\_\_, "Nutritional Disease of Phytophagous Fish," 1967, Halaszat 13: 105.

\_\_\_\_\_, "The Transport of Phytophagous Fish," 1967, Halaszat 13:40.

Ni, Ta-shu, "Methods of Feeding Ts'ao, Ch'ing, Lien and Yung Fishes," 1959, Collected Articles of the Second Plenary Conf. of the Committee of the Fish. Res. of the West Pacific., 65-91.

Nichol, J. T., "The Freshwater Fishes of China," 1943, In: Natural History of Central Asia, Vol 9 American Museum of Natural History, New York, 322 pp.

Nicholau, A., "Resultatele Cercetatiilor Eperimentele Efectuate la Nucet in Anii 1960-1962 cu Privire la Cresterea in Helesteie si Iernarea Speciilor Ctenopharyngodon idella si Hypophthalmichthys molitrix," 1962, Bul. Inst. Cerc. Pisc. 21(4):25-35.

\_\_\_\_\_, "Results of Investigations into the Acclimatizations in our Condition of Species of Herbivorous and Phytoplanton-Eating Fishes from China," 1966, Bul. Inst. Cercet. Pisc. 25(1):30-37 (in Rumanian).

\_\_\_\_\_, "Introducerca de noi Specii de Pesti, Mijloc de Sporire a Productiei," 1968, Natura, Buc. (Biol.) 20(5):76-78.

Nicholau, A., S. Luscan and E. Nichiteanu, "The Induced Spawning of the Phyto- and Planktophagous Fishes from the Experimental Station Nacet During 1966-1970," 1971, Stud. Cercet. Piscic. Inst. Cercet. Proiect. Aliment. 4: 273-298.

Nicholau, A., E. Popescu and St. Dragasanu, "Citeva Aspecte Privind Cresterea Speciilor de Pesti Fito si Planctonofage, Impreuna cu Crapul," 1969, Bul. Inst. Cercet. Piscic. 28(3):23-38.

Nicholau, A. and I. Steopoe, "The Oogenesis of Phytophagous Fish Species (Ctenopharyngodon idella, Hypophthalmichthys molitrix and Aristichthys nobilis), Reared in Controlled Units, in Romanian Waters," 1970, Bul. Cercet. Piscic. 29(3): 5-18.

NiDa-Su, "Method for Rearing White Amur, Black Amur, Tolstolobika and Variagated Tolstolobika," 1957, In: Doklady na 2 Sessii Mezhdunarodnoi Komissii.

\_\_\_\_\_, "Method for Rearing Ctenopharyngodon idella, Mylopharyngodon piceus, Hypophthalmichthys molitrix, Aristichthys nobilis," 1962, Sbornik Dokladov na. II. Plenum.

Nikolskii, G. V., "Amur Expedition of the Institute of Zoology of the Moscow University," 1947, Priroda No. 5: 75-77.

\_\_\_\_\_, "The Amur River and Its Freshwater Fishes," 1948, Nauka, Moscow.

\_\_\_\_\_, "Special Ichthyology," 1954, Transl. from Russian 1961, Office of Technical Services, U. S. Dept. of Commerce, Washington, D. C., Transl. by J. I. Lengy and Z. Krauthamer, 538 pp.

\_\_\_\_\_, "Fishes of the Amur Basin," 1956, Results of the Amur Ichthyological Expedition 1945-1949, Akademy Nauk SSSR, Moscow, 551 pp (in Russian).



Nikolskii, G. V., "The Ecology of Fishes," 1963, Academic Press, Inc., New York, Transl. from Russian by L. Birkett.

Nikolskii, G. V. and D. D. Aliev, "Role of Far Eastern Herbivorous Fish in Ecosystems of Natural Water Bodies Used for Acclimatization," 1974, Vopr. Ikhtiol. 14(6):974-979.

Nikolskii, G. V. and B. V. Verigin, "Main Biological Pecularity of Grass Carp, Silver Carp and Bighead Carp and Their Acclimatization in USSR," 1966, In: Phytophagous Fish, Moscow, N. G. Landa (ed.), pp 30-40 (in Russian).

\_\_\_\_\_, "Results of Research with Herbivorous Fish, Basic Objectives and Direction of Future Investigations. New Research on the Ecology and Propagation of Phytophagous Fishes," 1968, Nauka, Moscow, G. V. Nikolskii (ed.), p 12-19.

Nikolskii, G. V., B. V. Verigin, and O. A. Klyuchareva, "Fisheries of the Middle and Upper Reaches of the Amur in Connection with the Hydraulic Construction in Progress," 1960, Zool. Zh. 39(3).

Nikolskii, G. V., B. V. Verigin, A. P. Makeeva, and G. V. Popova, "Investigating Herbivorous Fish and Their Introduction for Fish Farming and Cleaning Reservoirs," 1968, Vest. Mosk. Uni. (Biol. Pochvoved.) 23(2):24-31.

Nikolskii, G. V., B. V. Verigin, A. N. Makeyeva, G. V. Popova, and S. G. Soin, "The Studies of Fishes Feeding Vegetation and Inclusion of Them Into the Practice of Fisheries and Melioration of Water Reservoirs," 1968, Vestn. Mosk. Univ. Ser. Biol. Pochvoved 23(2):24-31 (in Russian).

Nogusa, S., "A Comparative Study of the Chromosomes in Fishes with Particular Considerations of Taxonomy and Evolution," 1960, Mem. Hyogo. Univ. Agric. (Biol. Ser.) 3(1): 1-62.

Nosal, A. D., "The Production of Progeny and the Rearing of Grass Carp Under-Yearling at the Hatchery of the Mironovka-District Power Station," 1968, In: New Research on the Ecology and Propagation of Phytophagous Fishes, G. V. Nikolskii (ed.), Nauka, Moscow.

Nosal, A. D., B. A. Nikolyuk, V. P. Goroshko and O. M. Tarnasova, "Experience of the Production of Grass Carp Progeny in the Hatchery at the Mironovka District Power Station," 1966, In: Fisheries Exploitation of Phytophagous Fishes, Nauka, Moscow, pp 37-40.

Nosal, A. D., O. M. Tarasova and R. A. Baltadzhi, "Experiments on Rearing Summer-Old White Amur in the Mironovska Fish Collective," 1967, Rybn. Khoz. Resp. Mezhd. Temat. Nauch. Sb 4:3-4.

Novik, L. I., "Fish Weed Canals," 1973, *Gidrotekh. Melioratsiya*. 25(6): 12-13.

Oguri, M., "Studies on the Adrenal Glands of Teleosts. 3. On the Distribution of Chromaffin Cells and Interrenal Cells in the Head Kidneys of Fishes," 1960, *Bull. Jap. Soc. Scient. Fish.* 26(5):443-447.

\_\_\_\_\_, "Studies on the Freshwater Fishes of Japan," 1960, Prefectural University of Mie, Japan, 860 p.

Ojima, Y., M. Hayashi and K. Ueno, "Cytogenetic Studies in Lower Vertebrates X. Karyotype and DNA Studies in 15 Species of Japanese Cyprinidae," 1972, *Jap. J. Genet.* 47(6): 431-440.

Okoniewska, Z. and Z. Okoniewski, "Nutritional and Organoleptic Properties of Herbivorous Fish Flesh--White Amur and White Tolpyga," 1968, *Prezemysl Spozywczy* 22:304-307.

\_\_\_\_\_, "Preliminary Results of Investigations on the Weight of Commercially Useful Body Parts and Chemical Composition of Plant-Feeding Fish and Carp," 1969, *Roczn. Nauk Roln., Ser. H*. 91:385-401.

Opuszyński, K., "Further Success in Acclimatization of Phytophagous Fishes," 1964, *Gospod. Rybna* 16(5):4-5.

\_\_\_\_\_, "New Possibilities of Increasing Fish Production in Pond Cultures--The Acclimatization of Phytophagous Fish," 1964, *Ekol. Pol. B.* 10:201-214.

\_\_\_\_\_, "Comparison of Temperature and Oxygen Tolerance in Grass Carp (*Ctenopharyngodon idella* Val.), Silver Carp (*Hypophthalmichthys molitrix* Val.), and Mirror Carp (*Cyprinus carpio* L.)," 1967, *Ekol. Pol. A* 15(17):385-400.

\_\_\_\_\_, "Feeding of *Ctenopharyngodon idella* Val. on Aquatic Plants under Aquarium Conditions," 1967, *Roczn. Nauk. Roln., H* 90(3):453-462.

\_\_\_\_\_, "Carp Polyculture with Plant-Feeding Fish: Grass Carp (*Ctenopharyngodon idella* Val.) and Silver Carp (*Hypophthalmichthys molitrix* Val.)," 1968, *Bull. Acad. Pol. Sci.* 16(11):677-681.

\_\_\_\_\_, "Production of Plant-Eating Fish (*Ctenopharyngodon idella* Val. and *Hypophthalmichthys molitrix* Val.) in Carp Ponds," 1969, *Roczn. Nauk. Roln. H.* 91:221-309 (in Polish).

\_\_\_\_\_, "Present State and the Perspectives in Culture of Phytophagous Fish in Europe," 1971, In: *Proc. of the Symp. New Ways of Freshwater Fisheries Intensification*, Ceske Budejovice, 22-24 Sept 1971 Publ. by Fisheries Research Institute, Vodnany, Czechoslovakia, pp 58-72.

- Opuszynski, K., "Use of Phytophagous Fish to Control Aquatic Plants," 1972, *Aquaculture* 1:61-74.
- Opuszynski, K. and Z. Okoniewska, "Survival and Changes in Fat and Protein Content in the Body of Grass Carp, Silver Carp, and Carp During Wintering in Ponds," 1969, *Roczn. Nauk. Roln.* 90(4).
- Orlov, Y., "White Amur in Iran Waters," 1967, *Rybovod. Rybolov.* 1:20.
- Orlov, Yu. I. and E. I. Kruzhaline, "Methods of Transporting Herbivorous Fishes," 1966, In: *Fisheries Exploitation of Herbivorous Fishes*, Nauka, Moscow, 108-116 (in Russian).
- Osmanov, S. O., "On the Parasites of Phytophagous Fishes in the Uzbekistan," 1964, *Rybovod. Rybolov.* 1:30.
- Ovchynnyk, M. M., "Fish Culture in the U.S.S.R.," 1963, *Fishing News Internat.* 2(3):279-282.
- Parker, W. D., Jr., "The White Amur," 1969, *Alab. Cons.* 39:11-12.
- Pavlov, A. V. and P. D. Nelovkin, "Some Information on the Results of Transferring White Amur and Tolstolobik to the Basin of the Lower Volga," 1963, In: *Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR*, Akad. Nauk. Turkmensk. SSR, Ashkhabad, pp 169-170.
- Pentelow, F. T. K. and B. Stott, "Grass Carp for Weed Control," 1965, *Prog. Fish-Cult.* 27(4):210.
- Penzes, B. and J. Tölg, "Introduction in Hungary of the Fish Species (Ctenopharyngodon idella Cuv. and Val. and Hypophthalmichthys molitrix Cuv. and Val.)," 1964, *Allat. Közl.* 51(1-4):103-104.
- \_\_\_\_\_, "Aquaristic Investigations of the Plant Consumption of the Grass Carp (Ctenopharyngodon idella Cuv. and Val.)," 1966, *Z. Fischerei-Ztg.* 55:131-137.
- \_\_\_\_\_, "Etude de la croissance et de l'alimentation de la 'grass carp' (Ctenopharyngodon idella) en hongrie," 1966, *Bull. Fr. Piscic.* 39:70-76. *Weed Res. Organization annot. Bibliography* (223) No. 31 Oxford U. K.
- Philipose, M. T., "Present Trends in the Control of Weeds in Fish Cultural Waters of Asia and the Far East," 1968, *FAO Fish. Rep.* 44(5)26-52.
- Pochekaev, V. M., L. S. Berg, A. S. Bogdonov, N. I. Koshina and T. S. Rass, "Commercial Fishes of the USSR, Moscow Pishchepromizdat," 1949, 788 pp (pp 741-742).

Polosukhina, T. Y., E. A. Portugalskaya and K. S. Kuzhautaeva, "On the Role of the Liver in Cholesterol Metabolism in Fishes and Amphibians," 1969, Zh. Evol. Biokhim. Fiziol. 5:464-468.

Popescu, E. and S. Dragasanu, "The Problem of the Biological Productivity of Some Ecosystems Including Macrophyte-Eating Fishes," 1968, Hidrobiologia 9:181-185. English summary.

Posescu, E., S. Dragasanu and R. Giurca, "Contributions to the Improvement of the Technique of Inducing Spawning in Grass Carp (Ctenopharyngodon idella Val.)," 1970, Bul. Inst. Cercet. Piscic. 29(4):20-30.

Popescu, E., S. Dragasanu and S. Luscan, "Studies on the Viability of the Fry of Ctenopharyngodon idella During Embryonic and Larval Periods in Conditions of Artificial Reproduction," 1967, Bul. Inst. Cerc. Pisc. 26(1):5-11 (French and Russian summary).

Popescu, E., S. Dragasanu and G. D. Vasiliu, "Research on the Anaesthetic Effect of MS-222 Sandoz on Phytophagous Fishes," 1968, Bul. Inst. Cercet. Piscic. 27(1):35-43.

Popescu, E., R. Giurca and S. Dragasanu, "Contribution Concerning the Effect of some Gonadotropic on Cyprinus Carpio and Ctenopharyngodon idella (Val.) Gonads," 1970, Bul. Inst. Cercet. Piscic. 29(3):19-28.

Prikhodko, V. A., "Growth Ecology of Herbivorous Fishes (White Amur and Silver Carp) in Ponds of the Tsyurpinsk Hatchery," 1967, Rybn. Khoz. Mezhd. Temat. Nauch. SB 3:105-108.

Prikhodko, V. A. and L. I. Lupacheva, "The Diet Of Grass Carp," 1967, Rybn. Khoz. 43(3):58-60.

Prikhodko, V. A. and A. D. Nosal, "The White Amur in Ukrainian Ponds," 1961, Rybovod. Rybolov. (6):24.

\_\_\_\_\_, "An Attempt at Obtaining Young White Amur and Tolstolubik in the 'Nivka' Fish Farm. Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR," 1963, Akad. Nauk Turkmesk. SSR Ashkhabad, 138-144.

\_\_\_\_\_, "Production and Breeding of Grass Carp and Silver Carp in the Ukraine," 1966, In: Phytophagous Fish, N. G. Landa (ed.) Moscow 40-52 (in Russian).

\_\_\_\_\_, "Fisheries Exploitation of Phytophagous Fishes in the Ukraine," 1967, Trudy Ukr. Nauchno-issled. Inst. Rybn. Khoz. No. 5.

Prikhodko, V. A., A. D. Nosal, L. I. Lupacheva, O. M. Tarasova and I. M. Sherman, "Biotechnique of Rearing White Amur and Tolstolobik in Ponds in the Ukraine," 1965, Rybn. Khoz. (2):66-71.



Prikhodko, V. A. and A. M. Pistun, "Characteristics of Grass Carp Maturation in Ponds in Ukraine," 1971, Rybn. Khoz. Resp. Mezhd. Temat. Nauchn. SB (12): 70-74.

Prikhodko, V. A. and I. M. Sherman, "The Ecology of Growing Young-of-the-Year of Grass Carp in Monoculture and Jointly with Pond Carp," 1969, Rybn. Khoz. Respub. Mezhd. Temat. Nauch. Sb. (9):24-28.

Probatov, A. N., "On the Common Scaled Fishes of the Amur," 1935, Izv. Permsk. Biol. Inst. 10:1-2.

Prowse, G. A., "Vegetation Changes in Experimental Ponds," 1958, In: Proceedings of the Centenary and Bicentenary Congress of Biology, Singapore, pp 288-291.

\_\_\_\_\_, "The Tropical Fish Culture Research Institute," 1961, Malacca Federation of Malaya, Curr. Aff. Bull. Indo-Pacif. Fish. Counc. 32:2-3.

\_\_\_\_\_, "The Spawning of Grass Carp," 1962, Rep. Trop. Fish. Cult. Res. Inst., Malacca (61):13-16.

\_\_\_\_\_, "The Use of Fertilizers in Fish Culture," 1962, Proc. Indo-Pacif. Fish. Counc. 9(2-3):73-75.

\_\_\_\_\_, Letter to the Editor, 1966, Prog. Fish-Cult. 28(2):119-120.

\_\_\_\_\_, "Grass Carp--a Glutton for Water Weeds," 1967, Pest Articles and the News Summaries 13(3):246.

\_\_\_\_\_, "Some Aspects of Tropical Fish Culture," 1968, Internat. Verein. Theor. Angew. Limnol. Verh. 16(3):1405-1407.

\_\_\_\_\_, "The Role of Cultured Pond Fish in the Control of Eutrophication in Lakes and Dams," 1969, Verh. Internat. Verein. Limnol. 17:714-718.

\_\_\_\_\_, "Experimental Criteria for Studying Grass Carp Feeding in Relation to Weed Control," 1971, Prog. Fish-Cult. 33(3):128-131.

Purkett, C. A., Jr., "Grass Carp--Weed Eater or Pest?" 1963, Missouri Conservationist 34:19-20.

Radulescu, I. and R. Georgescu, "Noi Contributii la Cunoasterea Parazitofaunei Speciei Ctenopharyngodon idella din Apele R. P. Romane," 1963, Bul. Inst. Ceret. Piscic. 22(3):74-76.

\_\_\_\_\_, "New Contributions to the Knowledge of Parasite Fauna of the Species (Ctenopharyngodon idella) During Acclimation in Rumania," 1966, Biol. Inst. Cercet. Piscic. 25(2):48-51.

- Radulesku, I. and R. Georgesku, "Contributions to a Contagious Disease," 1969, Pseudorasbora parva Temm and Scig. Bul. Inst. Cercet. Piscic. 28(1):85-88.
- Raimdzhonov, N., "Species Composition of Fishes in the Sanzar River," Uzb. Biol. Zh. 16(2):39-42.
- Rehbronn, E., "Grass Carp?" 1967, Allg. Fischerei-Ztg. 92(18):549-551.
- Reich, K., "A Survey of Fish Breeding Research During the Period July 1951-December 1953," 1954, Bamidgeh 6(2):62-74.
- Remanycheva, O. D., "Rearing Grass Carp and Silver Carp in Fenced Sites in the Bay of Taganrog," 1973, Trud. Vses. Nauchno-issled. Inst. Morsk. Rybn. Khoz. Okeanogr. 94:189-199 (in Russian).
- Rimi, E. Ya., "Biochemical Changes Occurring in the Gonads of Grass Carp Females During Their Maturation," 1967, Biol. Nauk 10(8):51-55.
- Rimsh, E. Ya., "Some Peculiarities of Protein and Lipid Metabolism in White Amur," 1970, Rybovod. vestestvennykh vodoemakh, Trudy Vses. Khoz. Okeanografii (VNIRO), 74:222-243. Trans. by Bur. Foreign. Lang. Dir. Dep. of Sec. of State of Canada as translation Series No. 1770, 28 pp.
- Robson, T. O., "Efficiency of Grass Carp (Ctenopharyngodon idella Val.) in Controlling Submerged Water Weeds," 1970, Nature 266:870.
- Romanov, N. S., "Annotated Bibliography on Far Eastern Aquatic Fauna, Flora and Fisheries," 1959, Izdatelstova Akad. Nauk SSR, Moskva. Transl. U. S. Dept of Commerce, National Technical Information Service, Springfield, VA.
- Romanycheva, D. D., "Rearing of Grass Carp and Silver Carp in Fenced Sites in the Bay of Taganrog," 1973, Trud. Vses. Nauchno-issled. Inst. Morsk. Rybn. Khoz. Okeano. 94:189-198.
- Rozmanova, M. D., "Feeding of Ctenopharyngodon idella Larvae in Breeding Facilities," 1966, Dokl. Akad. Nauk SSSR 166(3):729-731.
- Ryabov, I. N., "Characteristics of the Embryonic and Larval Development of Hybrids of Silver Carp (Hypophthalmichthys molitrix Val.) and Grass Carp (Ctenopharyngodon idella Val.) with the Eastern Bream Abramis Brama Orientalis," 1973, Berg. J. Ichthyol. 13(5):701-714.
- Saanin, H., "Pond Culture in Indonesia in General," 1960, In: Lectures, 3rd International Inland Fisheries Training Centre, FAO, Rome, 29 pp.
- Sabodash, V. M., "Survival of White Amur Larvae Under the Effect of Zinc Sulfate," 1974, Gidrobiol. Zh. 10(6):93-96.

Saguri, M., "Experiment of Fry Collection of C. idellus," 1952, Report of Fish Culture Experiment for 1950. Fish. Agency, pp 47-54 (in Japanese, English summary).

Schäperclaus, W., "Fischkrankheiten," 1954, Verlag Akademie, Berlin, 708 pp.

\_\_\_\_\_, "Carp Culture in the German Democratic Republic," 1959, Deutsche Akad. Landwirtschaftswiss 7:7.

\_\_\_\_\_, "Lehrbuch der Teichwirtschaft," 1961, Paul Parey, Berlin, 582 pp.

\_\_\_\_\_, "New Possibilities for Increasing the Yield of Freshwater Fisheries by Means of Plant-Eating Fish from China," 1963, Dt. Fisheries Ztg 10(8):227-240.

\_\_\_\_\_, "Textbook of Pond Culture," 1973 (English translation by F. Hund). Fisheries Leaflet, Washington, D. C. (311) 260 pp.

Scheer, D., "Chinese Cyprinids, Their Nutrition, Growth Possibilities and Suitability for Acclimation, and Notes on Their Nomenclature," 1964, Z Fischerei NF 12(3-5):327-339.

Scheer, D. and H. Jähnichen, "The Grass Carp (Ctenopharyngodon idella)," 1967, Dt. Fischerei-Ztg. 14:129-130.

Scheer, D., H. Jähnichen and K. Grahl, "Beobachtungen bei der Haltung von ein- und zweisömmrigen Graskarpfen (Ctenopharyngodon idella) in Kleinen Teichen in Gebiet von Karl-Marx-Stadt," 1967, Dt. Fischerei-Ztg. 14:141-146.

Scheer, D., H. Jähnichen, K. Grahl, and W. Kasper, "Die Aufzucht von Graskarfen (Ctenopharyngodon idella) in den Teichwirtschaften Uhyst, Rietschen und Karl-Marx-Stadt im Jahre 1966," 1967, Dt. Fischerei-Ztg. 14:130-141.

Scheer, D., H. Jähnichen and H. Grahl and W. Kasper, "The Breeding of Grass Carp (Ctenopharyngodon idella) in the Fishery Ponds in Uhyst, Rietschen and Karl-Marx-Stadt in the Year 1966," 1967, Dt. Fischerei-Ztg. 14(5):130-141.

Schultz, D. E., C. J. Biggers and J. G. Stanley, "Electrophoresis of Blood Proteins of Hybrid and Gynogenetic Carp," 1975, ABS Bull. 22:77 (Abstract).

Schuster, W. H., "A Provisional Survey of the Introduction and Transportation of Fish Throughout the Indo-Pacific Region," 1952, Proc. Indo-Pac. Fish. Council. 3(2-3):187-196.

Schuster, W. H., "Fish Culture as a Means of Controlling Aquatic Weeds in Inland Waters," 1952, FAO Fish. Bull. 5(1):15-24.

Seymour, "Fish Culture in South China," 1885, Bull. U. S. Fish. Comm. (5):250.

Shell, W. E., "Herbivorous Fish to Control Pithophora and Other Aquatic Weeds in Ponds," 1962, Weeds 10:326-327.

Shepard, "Fish Culture in China," 1885, Bull. U. S. Fish. Comm. (5):340.

Sherman, I. M., "Cultivation of Grass Carp in Monoculture and with Domestic Carp in Southern Ukraine," 1971, Rybn. Khoz. Resp. Mezhd. Temat. Nauchn. SB(12): 78-80.

\_\_\_\_\_, "Some Individual Peculiarities of Embryogenesis of the Grass Carp, Ctenopharyngodon idella," 1971, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 18: 244-248.

Shimma, Y. and H. Shimma, "A Comparative Study on Fatty Acids Composition of the Native and Reared Silver Carps, Bigheads, and Grass Carp," 1969, Bull. Freshwater Fish. Res. Lab. 19(1):37-46.

Shivokene, Ya. S. and K. K. Yankyavichyus, "Role of Microorganisms of the Digestive Tract in the Nourishment of the Pond Fish," 1973, 2. The Number of Microorganisms from Several Physiological Groups. Liet. Tsr. Moksniu. Akad. Darb. Ser. B (1):183-194.

Shivokene, Ya. S., K. K. Yankyavichyus and V. N. Lubyanskene, "Role of Microorganisms of the Digestive Tract in the Nourishment of Pond Fish," 1973, 4. Synthesis of Free Amino Acids by Microorganisms. Liet. Tsr. Mosklui Akad. Darb. Ser. C. Biol. Mosklai 4:135-146 (in Russian).

Shivokene, Ya. S., K. K. Yankyavichyus, V. N. Lubyanskene, A. P. Pyachyueenas and L. A. Rachyunas, "Role of Microorganisms of the Digestive Tract in the Nutrition of Pond Fishes," 1972, 1. Quantitative Dynamics of the Microorganisms. Liet. Tsr. Moksniu. Akad. Darb. Ser. B (4):111-118.

Shrestha, S. B., "Induced Breeding of Grass Carp in Nepal," 1973, Bamidgh 25(1):10-16.

Sills, J. B., "A Review of Herbivorous Fish for Weed Control," 1970, Prog. Fish-Cult. 32(3):158-161.

Sinev, A. V., G. M. Ivanova and A. I. Gulyaev, "Infectious Dropsy of Grass Carp," 1966, In: Fish Diseases and Methods of Their Control. Nauka, Alma-Ata, 124.



Singh, S. B., S. C. Banerjee and P. C. Chakrabarti, "Preliminary Observations on Response of Young of Chinese Carps to Various Physicochemical Factors of Water," 1967, Proc. Acad. Sci. India Sect. B. 37(3):320-324.

Singh, S. B., K. K. Sukumaran and P. C. Chakrabarti, "Further Observations on Induced Breeding of Silver Carp and Grass Carp During 1968," 1970, Proc. Natl. Acad. Sci, India Sec. B. (Biol. Sci.) 40(3):88-98.

Singh, S. B., K. K. Sukumaran, P. C. Chakrabarti and M. M. Bagchi, "Observations on Composite Culture of Exotic Carps," 1972, J. Inland Fish. Soc. of India 4:38-50.

Singh, S. B., K. K. Sukumaran, K. K. Pillai and P. C. Chakrabarti, "Observations on Efficacy of Grass Carp (Ctenopharyngodon idellus Val.) in Controlling and Utilizing Aquatic Weeds on Ponds in Asia," 1967, Indo-Pac. Fish. Coun. Proc. 12: Sec. II:220-235.

Skorichenko, V., "The Use of Pituitary Injections on the Fish Breeding Enterprises of the Don and the Kuban," 1969, In: The Present State of the Method of Pituitary Injections. Astrakhan.

Slack, H. D., "The Maturation of Chinese Grass Carp (Ctenopharyngodon idellus C. et V.) in Tropical Waters," 1962, Malayan Agric. J. 43:299-308.

Sneed, K. E., "The White Amur: A Controversial Biological Control," 1971, Amer. Fish Farmer, May 6-9.

Sobolev, Yu. A., "The Nature of the Food of Young Grass Carp, Silver Carp and Pond Carp in Joint Rearing," 1966, In: 13th Scientific Conf. on Inland Waters of the Baltic Region. Tez. Dokl (an Abstract).

\_\_\_\_\_, "Food Interrelationships of Young Grass Carp, Silver Carp and Carp Reared Jointly in Ponds in Belorussia," 1970, J. Ichthyol. 10:528-533.

\_\_\_\_\_, "Natural Forage Reserve of Ponds During Breeding of Phytophagous Fishes Together with Carp," 1971, Hydrobiol. J. 7(5)66-73.

Soin, S. G., "A Production Experiment of Obtaining Mature Eggs of the Silver and Grass Carp with the Aid of Pituitary Injections in China," 1959, Rybn. Khoz. 35(8):67-73.

\_\_\_\_\_, "A Rotating Egg Incubation Apparatus for Chinese Species," 1959, Rybn. Khoz. 35(2):82-83.

\_\_\_\_\_, "Practical Experience in China in Obtaining Mature Eggs of Silver Carp and Grass Carp with Pituitary Injections," 1959, Rybn. Khoz. (8):67-73.

Soin, S. G. "Morphoecological Features of the Development of the Grass Carp and the Silver Carp," 1963, In: Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR, Akad. Nauk. Turkmensk. SSR, Ashkhabad, 100-119.

Soin, S. G. and A. I. Sukhanova, "Comparative Morphological Analysis of the Development of the Grass Carp, the Black Carp, the Silver Carp and the Bighead (Cyprinidae)," 1972, J. Ichthyol. 12(1):61-70.

Soreenivasan, A., "Induced Breeding of Grass Carp," 1972, FAO Aquaculture Bull. 5(1):4.

Stanley, J. G., "Energy Balance of White Amur Fed *Egeria*," 1974, Hyacinth Control J. 12:62-66.

\_\_\_\_\_, "Nitrogen and Phosphorus Balance of Grass Carp *Ctenopharyngodon idella*, Fed Elodea, *Egeria densa*," 1974, Trans Am. Fish. Soc. 103(3):587-592.

\_\_\_\_\_, "A Review of Methods for Obtaining Monosex Fish and Progress Report on Production of Monosex White Amur," 1976, Hyacinth Control J. (in press).

\_\_\_\_\_, "Production of Hybrid, Androgenetic and Gynogenetic Grass Carp and Carp," 1976, Trans. Amer. Fish. Soc. 105(1):10-17.

Stanley, J. G. and J. B. Jones, "Feeding Algae to Fish," 1976, Aquaculture (in press).

\_\_\_\_\_, "Morphology of Androgenetic and Gynogenetic Grass Carp, *Ctenopharyngodon idella* (Val.)," 1976, J. Fish Biol. (in press).

\_\_\_\_\_, "Incubators for Semi-Buoyant eggs," Prog. Fish-Cult. (in press).

Stanley, J. G., J. M. Martin and J. B. Jones, "Gynogenesis as a Possible Method for Producing Monosex Grass Carp (*Ctenopharyngodon idella*)," 1975, Prog. Fish-Cult. 37(1):25-26.

Stanley, J. G. and K. E. Sneed, "Artificial Gynogenesis and Its Application in Genetics and Selective Breeding of Fishes," 1973, FAO Fish. Circular (317):39 (Abstract).

\_\_\_\_\_, "Artificial Gynogenesis and Its Application in Genetics and Selective Breeding of Fishes," 1974, In: The Early Life History of Fish, J. H. S. Blaxter (ed.) Springer-Verlag, Berlin.

Statova, M. P., "The State of the Anterior Pituitary in Phytophagous Fishes Before and After Pituitary Injections," 1974, J. Ichthyol. 14(2):240-248.

Stechowski, S., "A Study Trip in the Soviet Union," 1962, Dt. Fischerei-Ztg. 10(12):356-374.

Stevenson, J. H., "Observations on Grass Carp in Arkansas," 1965, Prog. Fish-Cult. 27(4):203-206.

Stott, B., "Aquatic Weed Control by Grass Carp (Ctenopharyngodon idella Val.)," 1967, Proc. of the 3rd British Course Fish Conf. 3:62-65.

Stott, B., D. G. Cross, R. E. Iszard and T. O. Robson, "Recent Work on Grass Carp in the United Kingdom from the Standpoint of Its Economics in Controlling Submerged Aquatic Plants," 1971, Proc. Eur. Weed Research Council, 3rd Inten. Sym. Aquatic Weed, 105-116.

Stott, B., and L. D. Orr, "Estimating the Amount of Aquatic Weed Consumed by Grass Carp," 1970, Prog. Fish-Cult. 32(1):51-54.

Stott, B. and T. O. Robson, "Efficiency of Grass Carp (Ctenopharyngodon idella Val.) in Controlling Submerged Water Weeds," 1970, Nature 226(5248):870.

Strebkova, T. P., "Application of Anesthetics to Increase the Stocking Density of Fish During Transportation," 1970, Trud. Vses. Nauchno-issled. 66: 244-253.

\_\_\_\_\_, "Effect of Anesthetics on Nitrogen Metabolism in the Blood Serum of Grass Carp Fingerlings," 1972, Vopr. Fziologii ryb, Trud. Vses. Nauchno-issled. Inst. Morsk. Rybn. Khoz. Okeanogr. 85:145-147 Translated Bur. Multiling. Sves. Div., Vancouver, B. C. Trans. Ser. No. 3239, 7 pp.

Strelova, A. I., "Features of the Food of Grass Carp and Silver Carp Larvae," 1967, Conf. of Young Specialist on Pond Fish Farming. Tez Dokl.

\_\_\_\_\_, "Dietary Characteristics of Silver Carp and Grass Carp Larvae at Various Stages of Development," 1971, Trud. Vses. Nauchno-issled Inst. Prud. Rybn. Khoz. 18:188-194. Translated from Ref. Zh. Biol. 1971, No. 10196.

Stroganov, N. S., "Feeding of Sturgeon and Amur in Ponds," 1955, Rybn. Khoz. 31(10):36-39.

\_\_\_\_\_, "The Food Selectivity of the Amur Fishes," 1963, Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR. Akad. Nauk. Turkmensk. SSR, Ashkhabad. pp 181-191.

\_\_\_\_\_, "Growth and Sexual Maturation of Amur Fish in Moscow Region Ponds," 1964, Vopr. Ikhtirol. 4(4):664-671.

Stroganov, N. S. and N. S. Buzinova, "Enzyme Activity of the Digestive Tract of the White Amur," 1969, I amylase and lipase. Vestn. Mosk. Univ. Ser. 6 Biol. Pochvoved 24(3):27-31.

\_\_\_\_\_, "Seasonal and Age-Related Changes in the Liver and Intestines of the Grass Carp (Ctenopharyngodon idella) and Silver Carp (Hypophthalmichthys molitrix)," 1971, Biol. Nauk. 14(2):5-10.

Stroganov, N. S. and B. V. Verigin, "Materials on the Problem of the Acclimatization of the Amur Fishes in the European Part of the USSR," 1954, Zool. Zh. 33(1):127-135.

Stroud, R. H., "Exotic Fishes in United States Waters," 1975, Sports Fishing Inst. Bulletin, No. 264:1-4.

Sudzuki, K., M. Don and K. Vatanbe, "A Study of Artificial Rearing of Grass and Silver Carp Fry," 1963, Proc. of Fisheries Station, Perfect. Saitami 19:1-26 (in Japanese).

Sudzuki, K., K. Vatanbe, and G. Khara, "A Study of Artificial Rearing of the Grass Carp Fry," 1964, Proc. of Fisheries Station, Perfect. Saitami, 20:1-40 (in Japanese).

Sukhanova, A. I., "Development of Non-impregnated Row of Herbivorous Fish," 1972, Izv. Akad. Nauk Turkmansk SSR Biol. Nauk. 3:86-88.

Sukhanova, E. R., G. S. Karnienko, and A. I. Strelova, "The Development of Biological Techniques for Rearing the Larvae of the Silver Carp, Grass Carp and Black Carp to Viable Stages," 1969, S. B. Nauchno-Tekh. Inf. Krasnodar Fil. Vses. Nauchno-issled Inst. Prud. Rubn. Khoz. 1:45-50 (translated Ref. Zh. Biol. No 3I205 (1970)).

Sukhomlinov, B. F. and S. V. Matvienko, "Characteristics of the Blood Hemoglobins of the Grass Carp (Ctenopharyngodon idella Val.)," 1974, Gidrobiol. Zh. 10(5):104-108.

\_\_\_\_\_, "Structural Differences of Hemoglobins of Some Fishes," 1974, Zool. Zh. 53(2):299-301 (in Russian).

Sukhoverkhov, F. M., "Pond Fish Culture," 1953, Nauka, Moscow (in Russian).

\_\_\_\_\_, "Experience in Raising White Amur and Silver Carp in Ponds," 1958, All-Union Inst. of Marine Fisheries and Oceanography (VNIRO), Moscow, 1958.

\_\_\_\_\_, "Experiments on Transportation and Propagation of Amur and Tolstolobik," 1960, Rybn. Khoz. 36(12):15-22.



Sukhoverkhov, F. M., "Experimental Results and Perspectives of Rearing the Grass Carp, Silver Carp and Bighead in Pond Fish Farms of the European Part of the Russian Federation," 1963, In: Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR, Akad. Nauka Turkmanask, Ashkhabad, 48-59.

Sukhoverchov, F. M. and A. S. Pisarenkova, "On the Problem of Acclimatization of Asiatic Fishes in Europe," 1960, Zool. Listy 23(1):71-82.

\_\_\_\_\_, "The Rearing of 2nd Year Grass Carp and Silver Carp in Association with Carp in a High Stocking Rate in Fish Ponds of the Moscow Region," 1962, Trud. Noveshch. Ikhtiol. Komis. Akad. Nauk SSSR 14:68-73.

\_\_\_\_\_, "Comparative Productive Quality of Grass Carp (Ctenopharyngodon idella) Silver Carp (Hypophthalmichthys molitrix) and Bighead (Aristichthys nobilis)," 1962, Rybovod. Rybolov. 2:11-16.

Sundararaj, B. I., T. C. Anand, and V. R. P. Sinha, "Effect of Carp Pituitary Fractions on Vitellogenesis, Orarian Maintenance, and Ovulation in Hypophysectomized Catfish, Heteropreustes fossilis (Bloch), 1972, J. Endocrinol. 54(1):87-98.

Suto, F., "Experience on the Grazing of Grass Carp," 1966, Halaszat 12:40.

Sutton, D. L., "Controlling Aquatic Vegetation with Herbicides," 1974, Grounds Maintenance. August, 1974, 18-22.

\_\_\_\_\_, "Utilization of Hydrilla by the White Amur," 1974, Hyacinth Control J. 12:66-70.

\_\_\_\_\_, "A Hoe Hand with Fins," 1975, Weeds Today. 6(1):14-15.

Sutton, D. L. and R. D. Blackburn, "Feasibility of the Amur (Ctenopharyngodon idella Val.) as a Biocontrol of Aquatic Weeds," 1971, In: Technical Report on Herbivorous Fish for Aquatic Plant Control. Edited by E. O. Gangstad, J. J. Raynes and R. M. Burrell. 1-80.

Suzuki, S., "Study of Artificial Spawn Taking of Chinese Carps," 1963, Saitoma Perf. Fish. Exp. Sta. 20:1-40.

Suzuki, S., M. Tshchiya, K. Watanabe and Tamagawa, "Study of the Artificial Rearing of Grass Carp and Silver Carp," 1958, Saitamaken Suisan Shikerjo Gyomu Hokoku, 9 (in Japanese).

Suzuki, T. and N. Okabe, "Raising of Grass Carp Fry from Eggs Collected in Edo River," 1958, Suisan Shigen 4(2) (in Japanese).

Suzuki, T. and K. Takanashi, "Incubation of Eggs and Rearing of Fry of the Grass Carp (Ctenopharyngodon idellus) and the Silver Carp (Hypophthalmichthys molitrix) in Circulation Aquaria," 1961, Aquiculture, Tokyo 9(1):1-7.

Swingle, H. S., "Control of Pond Weeds by The Use of Herbivorous Fishes," 1957, Proc. South. Weed Conf. 10:11-17.

Szakolczai, J. and K. Molnar, "Veterinärmedizinische Untersuchungen an in Ungarn eingebürgerten pflanzenfressenden Fischarten," 1966, Z. Fischerei N. F. 14:139-152.

Szalay, M., "A bekalencse a Ctenopharyngodon taplaleka," 1964, Halaszat 10:111.

\_\_\_\_\_, "A feher amur intenziv ivadeknevelese," 1964, Halaszat 11(5):156-157.

\_\_\_\_\_, "The Intensive Hatchery Rearing of the Grass Carp," 1965, Halaszat 11(5):156-157.

Tan, Y. T., "Composition and Nutritive Value of some Grasses, Plants and Aquatic Weeds Tested as Diets," 1970, J. Fish Biol. 2:253-257.

\_\_\_\_\_, "Proximate Composition of Freshwater Fish--Grass Carp, Puntius Gonionotus and Tilapia," 1971, Hydrobiologia. 37(2):361-366.

Tanasitschuk, N. P., "On Acclimatization of Grass Carp in the Volga Delta," 1961, Vopr. Ichtiol. 1:171-178.

Tang, Y. A., "Report of the Investigation on Spawning of Chinese Carp in Ah Kung Tien Reservoir," 1963, Bull. Taiwan Fish. Res. Inst. (8):1-30.

\_\_\_\_\_, "Progress in the Hormone Spawning of Pond Fishes in Taiwan," 1965, Proc. Indo-Pacif. Fish. Council. 11.

\_\_\_\_\_, "Evaluation of Balance Between Fishes and Available Fish Foods in Multispecies Fish Culture Ponds in Taiwan," 1970, Trans. Am. Fish. Soc. 99(4):708-717.

Tang, Y. A., Y. W. Hwang, and C. K. Liu, "Reproduction of the Chinese Carps, Ctenopharyngodon idellus and Hypophthalmichthys molitrix in a Reservoir in Taiwan," 1960, Jap. J. Ichthyology 13:1-2.

\_\_\_\_\_, "Preliminary Report on Injection of Pituitary Hormone to Induce Spawning of Chinese Carps," 1963, Indo-Pac. Fish Council. occasional paper 63/14:1-7.

Tange, M., "Study on the Propagation of C. idellus for 1949," 1951, Rep. Fish. Experiment for 1949. Fish. Agency. p. 6.

Tashpulafov, E. A., "Data on the Hydrobiology of the Fish Ponds of the 'Urai' Fisheries," 1973, Uzb. Biol. Zh. 17(4) 48-49 (in Russian).

Tauchi, M., "Weed Control by Grass Carp," 1953, Suisan Zoshoku Sosho, 3:19 (in Japanese).

Tchang, T. L., "The Study of Chinese Cyprinoid Fishes," Pt. 1 Acta Zool. Sin. 11:1-259. 1952, Bamidgeh 4:205-213, 4:84-111.

Teodorescu-Leonte, R., "Culture of Chinese Carps and Weed Control," 1971, FAO Aquaculture Bull. 3(2):14.

Terrell, J. W. and A. C. Fox, "Food Habits, Growth, and Catchability of Grass Carp in the Absence of Aquatic Vegetation," 1974, Proc. 28th Ann. Conf. Southeastern Assoc. Game Fish Comm. 28:251-259.

\_\_\_\_\_, "Macrophyte Control by Grass Carp in Catfish Ponds," 1974, Proc. 28th Ann. Conf. Southeastn. Assoc. Game Fish Comm. 28:235-242.

Thorslund, A., "Fish Culture in Heated Lakes," 1971, FAO Aquaculture Bull. 3(3):7.

Timmermans, J. A., "LeControle de la vegetation aquatic dans les etanges delevage (Europe)," 1968, FAO Fish. Rep. 44(5):61-75.

Tölg, I., "Sullogazdalkodas alapjai Magyarorszagon," 1964, Halaszat, 10(6):190-191.

\_\_\_\_\_, "The Limnological Significance of the Eastern Asiatic Phytophagous Fishes in the European Fish Stock," 1967, Acta Zool. Acad. Scient. Hungaricae 9(3-4):445-458.

\_\_\_\_\_, "Changes in the Basis of Circulation of Organic Matter in Waters Due to Grass-Carps Introduced from East Asia," 1968, Acta. Biol. Acad. Sci. Hung. 19(4):529.

Toth, J., "Data on the Presence of Plantivorous Fishes Imported from the Far East in the Middle Reach of the Danube (Danubialia Hungarica LXI)," 1971, Ann. Univ. Sci. Budap. Rolando Eotvos Nominatae Sect. Biol. 13:327-328.

Tryapshene, O. P. and K. K. Yankyavichyus, "Vitamin B Complex in the Food and Separate Organs of the Carp, White Amur and Tench Under Natural Feeding Conditions," 1974, 3. Vitamin Content in the Tissues and Organs of Third-Year Fish. Liet Tsr. Mokslu. Akad. Darb. Ser. C Biol. Mokslai 4:93-100.

- Tryapshene, O. P., K. K. Yankyavichyus and V. N. Lubyanskene, "Vitamin B Complex in the Food and Separate Organs of the Carp, White Amur and Tench under Natural Feeding Conditions," 1974, 2. Vitamin Synthesis by Intestinal Bacteria of First and Second-Year Fish. Liet. Tsr. Mokslau Akad. Darb. Ser. C. Biol. Mosklai 3:129-139.
- Tshariev, R. and D. S. Aliev, "The Use of Grass Carp for Water Weed Control at the Ponds Stocked with Carp," 1966, In: Fisheries Exploitation of Phytophagous Fish. Nauka, Moscow. pp. 77-82 (in Russian).
- Tsia, Jen-ta, Hau, and Yao, "Application of Tracer Atoms to Study the Digestion, Absorption and Mechanisms of Monocellular Green Algae Among Ts'ao, Ching, Loen, and Yung Fishes," 1962, Atomic Energy Science and Technology (3):231-234.
- Tsui, Y. K., "A Preliminary Study of Growth Rate of Grass-Carp, Bighead, Silver Carp, Mud Carp and the Common Carp," 1936, Fish. Newsletter 1(1):35-51 (in Chinese).
- Tubb, J. A., "Status of Fish Culture in Asia and the Far East," 1967, FAO Fish. Rep. 44(2): 45-53.
- Turdakov, A. F. and N. A. Aminova, "Study of the Heat Resistance of Spermatozoa of Several Species of Bony Fishes," 1973, J. Ichthyol. 13(2):198-204.
- Tyunyakov, V. M., "A Comparative Characterization of the Venous Flow Between Organs of the Digestive Tract of Fish with Different Kinds of Diets," 1969, Sb. Nauch. Rab. Volgograd. Med. Inst. 21(2):118-121.
- Vaas, K. F. and M. Sachlan, "Notes on Fisheries Exploitation of the Artificial Lake Tjiburuj in West Java," 1952, Pember. Balai Besar Penjel. Pertan. 128:1-22.
- Van Dyke, Jess M., "A Nutritional Study of the White Amur (Ctenopharyngodon idella Val.) Fed Duckweed (Lemna minor L.)," 1973, M.S. Thesis, University of Florida, 35 pp.
- Vasnetsov, V. V., "Experimental Comparative Analysis of Linear Growth in the Family Cyprinidae," 1934, Zool. Zh. 8(3).
- \_\_\_\_\_, "Acclimatization of the Amur River Fishes in Waters of the European Part of the USSR," 1951, Trudy Inst. Morfol. Zhiv. 5:5-10.
- \_\_\_\_\_, "Possibilities of Acclimatization of Several Amur Fishes in the Waters of the European Part of the USSR," 1951, Trud. Inst. Morfol. Zhiv. 5:117-120.
- \_\_\_\_\_, "Experience in Analyzing the Growth of the Amur Fishes," 1958, Results of the Amur Ichthyological Expedition, 1945-1949, Vol. IV, Academy Nauk. SSSR, Moscow.



Verigin, B. V., "Foreign Experience in the Rearing, Acclimatization and Breeding of Grass Carp, Silver Carp and Bighead," 1961, In: N. G. Landa (ed.) *Phytophagous Fish*, Moscow. pp. 56-81.

\_\_\_\_\_, "On the Results and Perspective Work with Amur Phytophagous Fishes," 1961, *Trudy. Vses. Soveshch. Prud. Rybovod.*

\_\_\_\_\_, "Results of Work on Acclimation of Far Eastern Phytophagous Fishes and Measures for the Further Assimilation and Study in New Regions," 1961, *Vopr. Ikhtiol.* 1(4):640-649.

\_\_\_\_\_, "Modern State and Future Perspective of Utilization of the Silver and Grass Carp for Fisheries in Water-Bodies of the U.S.S.R," 1963, In: *Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR*, Akad. Nauk Turkmenk SSR, Ashkhabad, 20-39.

\_\_\_\_\_, "The Problem of the Biological Improvement of the Coolant Reservoirs of the Thermo-Electric Power Stations and Their Fisheries Exploitation," 1963, In: *Problems of the Fisheries Exploitation of Plant-Eating Fishes in Waters of the USSR*. Akad. Nauk Turkmenk SSR, Ashkhabad, pp 93-96.

\_\_\_\_\_, "Thermal Power Stations and Fisheries," 1963, *Rybn. Khoz.* 9:14-18 (in Russian).

Verigin, B. V., N. Viet and N. Dong, "Data on the Food Selectivity and the Daily Ration of White Amur," 1963, In: *Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR*, Akad. Nauk Turkmenk SSR, Ashkhabad, 192-195.

Vinogradov, V. K., "Fish Farms for Plant-Eating Fishes," 1965, *Rybovod. Rybolov* (2):4-7.

Vinogradov, V. K., "The Present Stage of Biotechnique for the Reproduction and Breeding of Phytophagous Fishes," 1966, In: *Phytophagous Fishes*, N. G. Landa (ed.), Nauka, Moscow. 14-29.

\_\_\_\_\_, "Techniques of Rearing Phytophagous Fishes," 1968, *FAO Fish. Rep.* 44(5):227-233.

\_\_\_\_\_, "Cultivation of Herbivorous Fishes," 1971, *Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz.* 17:106-121.

\_\_\_\_\_, "Methods Used for Obtaining Progeny from Plant-Eating Fish," 1963, *Rybovod. Rybolob.* (6):9-13.

Vinogradov, V. K. and L. V. Erokhina, A. G. Kondradt and G. I. Savin, "The Biological Technique of the Propagation of Phytophagous Fishes," 1965, *Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz.* 13:3-9.

Vinogradov, V. K., L. V. Erokhina, A. G. Kondradt and G. I. Savin, "On the Biotechniques of Artificial Rearing of Phytophagous Fishes," 1966, In: Fisheries Exploitation of Phytophagous Fishes. Nauka, Moscow (ed. G. V. Nickolskii).

\_\_\_\_\_, "Methods of Artificial Breeding of Herbivorous Fishes," 1966, In: Cultivation of Herbivorous Fishes. Nauka, Moscow. 17-29.

Vinogradov, V. K. and L. V. Erokhina, "Effect of Temperature on Embryonic Development of Herbivorous Fishes," 1967, Trud. Vses. Nauch-issled. Inst. Prud. Rybn. Khoz. (15):70-76.

Vinogradov, V. K., L. V. Erokhina, G. I. Savin, L. V. Khromov and A. D. Danchenko, "The Biological Techniques of Commerce at Breeding and Rearing of Phytophagous Fishes," 1968, In: New Research on the Ecology and Propagation of Phytophagous Fishes, Nauka, Moscow (ed. G. V. Nikolskii).

Vinogradov, V. K. and L. Khromov, "Rearing the Larvae of Phytophagous Fishes, 1967, Rybovod. Rybolov. No. 5.

Vinogradov, V. K. and Z. K. Zolotova, "Effect of the White Amur on Ecosystems of Water Bodies," 1974, Gidrobiol. Zhn. 10(2):90-98.

Vovk, P. S. "Breeding Amur Fishes in Ukrainian Ponds," 1956, In: Soveshchanie po biologicheskim osnovam rybnogo khozyaistva. Tezisy Dokladov. pp 83-86.

\_\_\_\_\_, "Breeding White Amur and Tolstolobik in the Nikva Fish Farm," 1957, Rybn. Khoz. 33(12):73-75.

\_\_\_\_\_, "Results of the Creation Works of the Spawner Stocks of Plant-Eating Fish in Artificial Water Reservoirs of the USSR," 1963, In: Translations of the First Meeting of the Fisheries Reservoir Studies of Georgia, pp 155-161.

\_\_\_\_\_, "Experiments of the Propagation of the Grass Carp at the Alexandria Experimental Station," 1966, In: Fisheries Exploitation of Phytophagous Fishes. Nauka, Moscow, G. V. Nikolskii, (ed.), pp 41-49.

\_\_\_\_\_, "Results of Research on the Development of Biological Techniques for the Propagation of the Grass Carp Under Conditions of the Ukrainian Forest-Steppe," In: New Research on the Ecology and Propagation of Phytophagous Fishes. Nauka, Moscow (ed. G. V. Nikolskii).

Vovk, P. S. and V. A. Prikhodko, "Conditions and Problems Associated with the Acclimation of Grass Carp and Silver Carp in the Ukraine," 1963, In: Problems of the Fisheries Exploitation of Phytophagous Fishes in Waters of the USSR, Akad. Nauk. Turkman SSR, Ashkhabad. 39-47.

- Walker, C. R., "Biological and Integrated Control of Aquatic Weeds in Fisheries Management," 1972, In: Abstracts, Weed Sci. Soc. Am., 59.
- Waugh, G. D., "Grass Carp May Be the Answer to the Problem of Water Weeds," 1970, Ammohouse Bull. 1:6-8.
- Weber, E., "Control of Aquatic Weeds by White Amur," 1974, In: Proc. 4th Eur. Weed. Res. Counc. Intern. Symp. on Aquatic Weeds, Vienna, 134-138.
- Wenzel, S., "4 Years of Rearing the Grass Carp at the Reitschen Pond Management," 1970, Dt. Fischerei-Ztg. 17(3):81-83.
- Willemesen, J., "De Chinese graskarper, Ctenopharyngodon idella," 1961, Viss. Nieuws 18:237-240.
- Wolny, P., "Polyculture of Common Carp with Grass Carp and Bighead," 1968, Gospod. Rybna. 1:18-20 (in Polish).
- \_\_\_\_\_, "Phytophagous Fish Acclimated in Poland," 1969, Olsztyn-Zabieniec (in Polish).
- Woyanovich, E., "Chinesische pflanzenfressende Fischarten in Europe," 1965, Allg. Fisch. Ztg. 90(15):459-460.
- \_\_\_\_\_, "New Systems and New Fishes for Culture in Europe," 1968, FAO Fish. Rep. 44(5):162-181.
- Wu, H. W. and L. Chung, "Progress and Achievements in the Artificial Spawning of Four Farm Fish in China," 1964, Peking Symp 10:203-218.
- Wu, Wilson Sheug-Yu, "A Disease of the Grass Carp (Ctenopharyngodon idellus) and Its Chemotherapeutical Control," 1971, Joint Comm. on Rural Reconstruction Fisheries Serv. No. 11. Taipei, Taiwan.
- \_\_\_\_\_, "An Investigation of a Disease of the Fresh Water Fish Ctenopharyngodon idellus and its Chemotherapeutic Control," 1971, Taiwan 16(1):105-110.
- Wurtz, A., "Ertragssteigerung in Teichen mit säurem Boden durch Haferkultur," 1956, Dt. Fisch. Ztg. Radebeul (3).
- \_\_\_\_\_, "Fish Culture in Certain European Countries," 1960, Stud. Rev. Gen. Fish. Counc. Mediterr. 11:11.
- Yakovchyk, T. A., "On Parasites and Diseases of Herbivorous Fishes at Some Pond Farms of the Krasnodar District," 1971, Trud. Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 18:283-285.
- Yashouv, A., "Acclimatization of New Species in the Fishponds of the Station," 1958, Bamidgeh 10(4):75-80.

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Yeh, Ye-tsu, "A Preliminary Report on the Oxygen Consumption, Energy Requirements, Asphyxiation Point and Respiratory Quotient of Fish Fry and Young Fish," 1959, Acta Zool. Sinica 11:117-138 (in Chinese).

Yeo, R. R. and T. W. Fisher, "Progress and Potential for Biological Control as the Fish Pathogens Competitive Plants and Snails," 1970, 1st FAO Int. Conf. Weed Control, Univ. of Calif. Davis WC/70/WP/37, pp 15.

Yoshikoshi, Y., "Report on the Fish Fry Industry of West River," 1939, Canton Bureau of Agriculture and Forestry, J. Fish. No. 43 (in Chinese).

Yu, Y. S., "A Brief Survey of Pond Culture in Kwangtung Province," 1936, Fisheries Newsletter 1(1):51-53 (in Chinese).

Yudin, V. L., "Grass Carp in a Rice-Fish Rotation," 1968, In: G. V. Nikolskii (ed.) New Research on the Ecology and Propagation of Phytophagous Fishes, Nauka, Moscow, 143-146.

Yukhimenko, S. S., "The Occurrence of Bothriocephalus Gowkongensis Yeh, 1955 (Cestoda) in the Young of Cyprinidae from the Amur River," 1970, Parazitologiya 4(5):480-483.

\_\_\_\_\_, "Parasites of Young Silver Carp Hypophthalmichthys molitrix (Val.) and Grass Carp Ctenopharyngodon idella (Val.) in the Amur River," 1972, Izv. Tikhookean. Nauchno-issled. Inst. Rybn. Khoz. Okeanogr. 77:151-159.

Yu-t'ien Chen-nan, Ch'iao-pen Faug-lang, "(Ctenopharyngodon idella Val.) Digestion of High Grade Carbohydrates," 1949, Japan. J. Aquatic Products 15(6):259-261.

Zeit, G., "Stocking of a New Agent for the Effective Control of Undesirable Pond Plants," 1964, Alleg. Fischerei-Ztg. 89(1):13-16.

Zolotova, Z. K., "Food Preference of Grass Carp," 1966, Trudy Vses. Nauchno-issled. Inst. Prud. Rybn. Khoz. 14:39-50.

\_\_\_\_\_, "A Note on the Food Preference of Grass Carp," 1967, Ref. Zh. Biol. No. 11193. Biol. Abs. 1968. No. 108966.

\_\_\_\_\_, "Biological Weed Control in Irrigation Canals with the Aid of Grass Carp," 1970, Vses. Nauch-issled. Inst. Prud. Rybn. Khoz. 18(4):112-126.

Zolotova, Z. K. and L. V. Kuromov, "The Weeding Role of Grass Carp," 1970, Rybovod. Rybolov. (4):8.

Zon, J. C. J. van, "The Grass Carp in Holland," 1974, In: Proc. 4th Eur. Weed. Res. Counc. Intern. Symp. on Aquatic Weeds, Vienna, 128-133.

Zubareva, E. L., "Experiment in the Introduction of Herbivorous Fish to Cooling Reservoir in the Urals," 1968, In: G. V. Nikolskii (ed.) New Research on the Ecology and Propagation of Phytophagous Fish. Nauka, Moscow 225-227.

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